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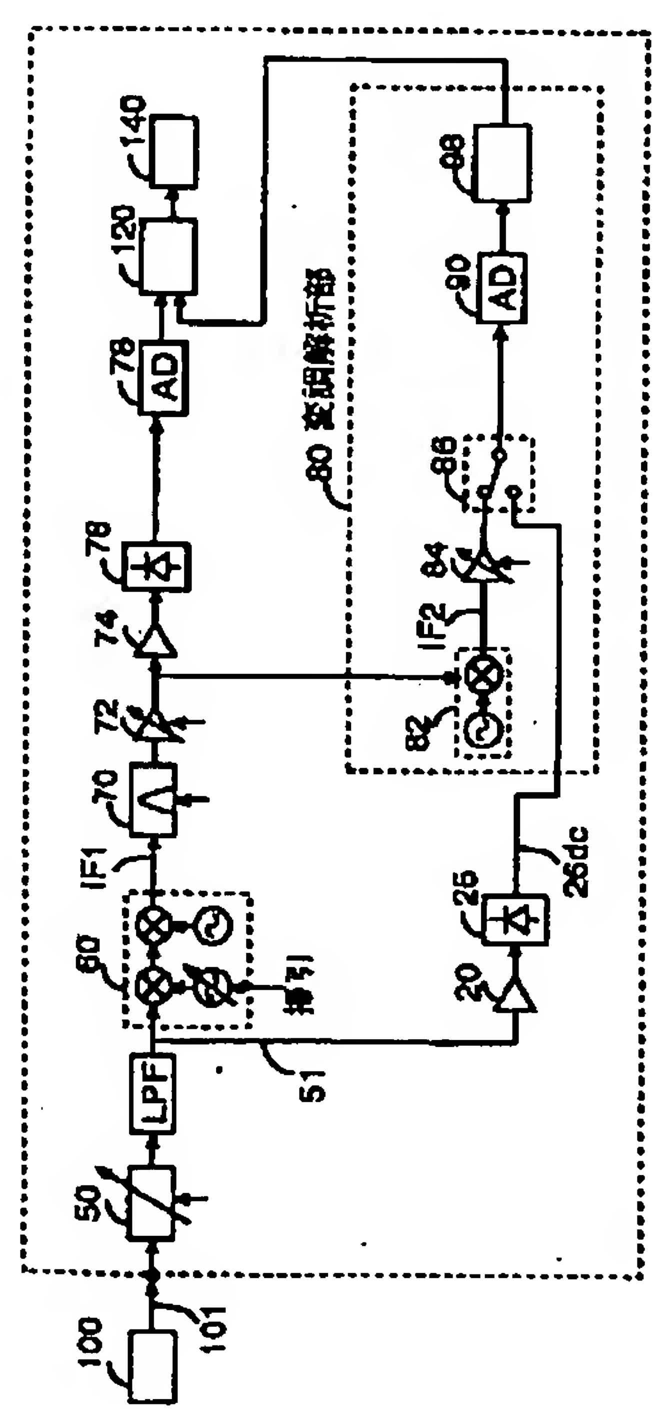
(54)【発明の名称】 変調解析装置及びスペクトラムアナライザ

(57)【要約】

【課題】広帯域に分布した被測定周波数信号においても入力レベルの最適化を実現可能とした変調解析装置及びスペクトラムアナライザを提供。

【解決手段】入力減衰器によって減衰した未知電力減衰信号を検出する手段を具備し、第1に上記未知電力レベル値が所定上限値より高い場合は減衰量を増加し、第2に上記未知電力レベル値が所定下限値より低い場合は減衰量を減少する手段を具備し、得た減衰レンジ及び前後の減衰レンジにおいて、被測定信号のパワー測定帯域を含む区間を周波数変換部で周波数掃引して被測定信号の電力を各々測定算出し、これから最適な減衰レンジに設定制御する手段を具備し、上記減衰レンジの設定に連動して中間周波数の可変ゲインアンプのゲインを制御して測定系全体のゲインを所定の状態にゲイン制御する手段を具備する。



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【特許請求の範囲】

【請求項１】　未知電力の被測定信号を受けて、入力減衰器により減衰させ、減衰した未知電力減衰信号を受けて周波数変換部で所定の中間周波数に周波数変換し、これをＩＦフィルタによりフィルタし、変調解析部に供給して変調解析を行う変調解析装置において、
該入力減衰器によって減衰した未知電力減衰信号を受けて、該信号を増幅し検波して該入力減衰器の出力端における未知電力レベルを検出する手段と、
第１に該未知電力検出手段で得た電力レベル値が所定上限値より高い場合は該入力減衰器の減衰量を増加する方向に減衰レンジを設定制御し、第２に該未知電力検出手段で得た電力レベル値が所定下限値より低い場合は該入力減衰器の減衰量を減少する方向に減衰レンジを設定制御する手段と、
上述で得た減衰レンジ及び前後の減衰レンジにおいて、被測定信号のパワー測定帯域を含む区間を周波数変換部で周波数掃引して被測定信号の電力を各々測定算出し、この測定電力値をもとに最適な減衰レンジに設定制御する手段と、
該減衰レンジの設定に連動して中間周波数の可変ゲインアンプのゲインを制御して測定系全体のゲインを所定の状態にゲイン制御する手段と、
以上を具備していることを特徴とした変調解析装置。

【請求項２】　未知電力の被測定信号を受けて、入力減衰器により減衰させ、減衰した未知電力減衰信号を受けて周波数変換部で所定の中間周波数に周波数変換し、これをＩＦフィルタによりフィルタして測定するスペクトラムアナライザにおいて、
該入力減衰器によって減衰した未知電力減衰信号を受けて、該信号を増幅し検波して該入力減衰器の出力端における未知電力レベルを検出する手段と、
第１に該未知電力検出手段で得た電力レベル値が所定上限値より高い場合は該入力減衰器の減衰量を増加する方向に減衰レンジを適設定制御し、第２に該未知電力検出手段で得た電力レベル値が所定下限値より低い場合は該入力減衰器の減衰量を減少する方向に減衰レンジを設定制御する手段と、
上述で得た減衰レンジ及び前後の減衰レンジにおいて、被測定信号のパワー測定帯域を含む区間を周波数変換部で周波数掃引して被測定信号の電力を各々測定算出し、この測定電力値をもとに最適な減衰レンジに設定制御する手段と、
該減衰レンジの設定に連動して中間周波数の可変ゲインアンプのゲインを制御して測定系全体のゲインを所定の状態にゲイン制御する手段と、
以上を具備していることを特徴としたスペクトラムアナライザ。

【請求項３】　未知電力の被測定信号を受けて、入力減衰器により減衰させ、減衰した未知電力減衰信号を受け

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て周波数変換部で所定の中間周波数に周波数変換し、これをＩＦフィルタによりフィルタし、変調解析部に供給して変調解析を行う変調解析装置において、
周波数変換部は周波数を非掃引とし、変調解析部内の周波数変換部で更に低い第２の中間周波数信号に変換した信号を受けて、該第２の中間周波数信号の３次高調波成分まで信号処理可能な高速ＡＤ変換器を用いてデジタルデータに変換して該第２の中間周波数信号の３次高調波成分を測定する手段と、
前記３次高調波成分の測定手段により該入力減衰器の減衰レンジの減衰量を順次変えて各々３次高調波成分を測定する手段と、
前記で得た３次高調波成分の各減衰レンジ毎の値を受けて、３次高調波成分が増加に転ずる減衰レンジを特定し、これから入力減衰器の減衰レンジを最適レンジに設定する手段と、
該最適レンジ設定に連動して中間周波数の可変ゲインアンプのゲインを制御して測定系全体のゲインを所定の状態にゲイン制御する手段と、
以上を具備していることを特徴とした変調解析装置。

【請求項４】　未知電力の被測定信号を受けて、入力減衰器により減衰させ、減衰した未知電力減衰信号を受けて周波数変換部で所定の中間周波数に周波数変換し、これをＩＦフィルタによりフィルタして測定するスペクトラムアナライザにおいて、
周波数変換部は周波数を非掃引とし、変調解析部内の周波数変換部で更に低い第２の中間周波数信号に変換した信号を受けて、該第２の中間周波数信号の３次高調波成分まで信号処理可能な高速ＡＤ変換器を用いてデジタルデータに変換して該第２の中間周波数信号の３次高調波成分を測定する手段と、
前記３次高調波成分の測定手段により該入力減衰器の減衰レンジの減衰量を順次変えて３次高調波成分を各々測定する手段と、
前記で得た３次高調波成分の各減衰レンジ毎の値を受けて、３次高調波成分が増加に転ずる減衰レンジを特定し、これから入力減衰器の減衰レンジを最適レンジに設定する手段と、
該最適レンジ設定に連動して中間周波数の可変ゲインアンプのゲインを制御して測定系全体のゲインを所定の状態にゲイン制御する手段と、
以上を具備していることを特徴としたスペクトラムアナライザ。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は、被測定周波数信号の入力レベルの最適化に関する。特にスペクトラム拡散された広帯域に分布する被測定周波数信号の入力レベルの最適化に関する。

【０００２】

【従来の技術】従来技術例について図５の変調解析装置の構成図を示して説明する。この変調解析装置は、スペクトラムアナライザを基本構成にし、この中間周波数信号（ＩＦ信号）を受けて、被測定信号の各種変調に関わる解析機能を付加した構成例である。

【０００３】構成は、被試験装置１００と、入力減衰器５０と、周波数変換部６０と、ＩＦフィルタ７０と、可変ゲインアンプ７２と、対数変換部７４と、検波部７６と、ＡＤ変換器７８と、変調解析部８０と、表示処理部１２０と、表示装置１４０とで成る。尚、スペクトラムアナライザの構成は技術的に良く知られている為説明を省略する。

【０００４】変調解析部８０の内部構成は、周波数変換部８２と、可変ゲインアンプ８４と、ＡＤ変換器９０と、信号処理部９８とで成る。この変調解析部は、周波数変換部８２により数ＭＨｚの低い中間周波数信号ＩＦ２に変換し、可変ゲインアンプ８４でＡＤ変換器９０の最適レベルに増幅した中間周波数信号をＡＤ変換器９０で高速サンプリングし、信号処理して各種の変調特性等の解析や変調精度に係る測定と演算処理をするものである。処理された結果は表示処理部１２０を介して表示装置１４０で所望の表示をする。

【０００５】ところで変調測定に際して表示装置１４０の管面上の表示レベルを使用者が定める必要がある。この管面レベルを設定する一手順を説明する。ここで被試験装置１００が出力する被測定信号１０１は、図６（ａ）に示す周波数信号２０１のように、ＣＤＭＡ（Code Division Multiple Access）等の広帯域に分布するスペクトラム拡散された周波数信号の場合と仮定する。先ず図６（ａ）に示す中心周波数ｆc付近に設定し、ゼロスパン・モード（周波数を掃引しないモード）で入力レベルを管面表示させる。そしてキー入力設定により、スペクトラムレベルが大きく見易くなる所望の入力感度及びリファレンスレベルに設定する。この設定の結果入力減衰器５０とＩＦ信号用の可変ゲインアンプ７２は所定の減衰量及び増幅量に自動設定される。尚、入力減衰器５０は例えば１０ｄＢステップの減衰器であり、可変ゲインアンプ７２は例えば０．１ｄＢ／Div. ステップの細かな可変増幅器である。

【０００６】

【発明が解決しようとする課題】ところで、図６（ａ）に示すように、広帯域に分散した周波数信号２０１の為、各周波数点でのレベルは低い。この為、上述管面表示レベルの設定に伴って、入力減衰器５０の設定は小さい減衰量になっている。しかしながら広帯域に拡散した全周波数の総電力は大きいレベルである。この結果、図５に示す入力減衰器５０で減衰した未知電力減衰信号５１は比較的大きなレベルである。この信号が周波数変換部６０のミキサ回路の入力端に供給される。この結果、ミキサ回路は過大な入力レベルとなる場合がある。もし過大入力レベルの場合は、被測定周波数信号が歪んでＮ次高調波を生じたり、周波数変換ゲインの直線性が大きく変わる等の不具合を生じる。これら不具合は、被試験装置の変調解析や電力測定の誤差を増長させる為、測定装置としては好ましくなく、実用上の難点がある。尚、図５に示す変調解析部８０を有しない一般的なスペクトラムアナライザにおいても広帯域に分布あるいは離散した未知電力の周波数信号等においては、同様の難点があることは言うまでもない。

【０００７】そこで、本発明が解決しようとする課題は、広帯域に分布あるいは離散した被測定周波数信号においても入力レベルの最適化を実現可能とした変調解析装置及びスペクトラムアナライザを提供することである。

【０００８】

【課題を解決するための手段】第１図あるいは第２図と第１０図は、本発明の変調解析装置に係る解決手段を示している。第１に、上記課題を解決するために、本発明の構成では、未知電力の被測定信号１０１を受けて、入力減衰器５０により減衰させ、減衰した未知電力減衰信号５１を受けて周波数変換部６０で所定の中間周波数ＩＦ１に周波数変換し、これをＩＦフィルタ７０によりフィルタし、変調解析部８０に供給して変調解析を行う変調解析装置において、入力減衰器５０によって減衰した未知電力減衰信号５１を受けて、この信号を増幅し検波して入力減衰器５０の出力端における未知電力レベルを検出する手段を具備し、第１に上記未知電力検出手段で得た電力レベル値が所定上限値より高い場合は入力減衰器５０の減衰量を増加する方向に減衰レンジを設定制御し、第２に上記未知電力検出手段で得た電力レベル値が所定下限値より低い場合は入力減衰器５０の減衰量を減少する方向に減衰レンジを設定制御する粗調整の手段を具備し、上述で得た減衰レンジ及び前後の減衰レンジにおいて、被測定信号１０１のパワー測定帯域を含む区間を周波数変換部６０で周波数掃引して被測定信号１０１の電力を各々測定算出し、この測定電力値から最適な減衰レンジに設定制御する最適調整の手段を具備し、上記減衰レンジの設定に連動して中間周波数の可変ゲインアンプ７２のゲインを制御して測定系全体のゲインを所定の状態にゲイン制御する手段を具備する構成手段である。上述粗調整と最適調整の手段により、広帯域に分布した被測定周波数信号に対しても入力レベルの最適化を実現可能とした変調解析装置が実現できる。

【０００９】第４図は、本発明のスペクトラムアナライザに係る解決手段を示している。第２に、上記課題を解決するために、本発明の構成では、未知電力の被測定信号１０１を受けて、入力減衰器５０により減衰させ、減衰した未知電力減衰信号５１を受けて周波数変換部６０で所定の中間周波数ＩＦ１に周波数変換し、これをＩＦフィルタ７０によりフィルタして測定するスペクトラム-

アナライザにおいて、入力減衰器５０によって減衰した未知電力減衰信号５１を受けて、この信号を増幅し検波して入力減衰器５０の出力端における未知電力レベルを検出する手段を具備し、第１に上記未知電力検出手段で得た電力レベル値が所定上限値より高い場合は入力減衰器５０の減衰量を増加する方向に減衰レンジを設定制御し、第２に上記未知電力検出手段で得た電力レベル値が所定下限値より低い場合は入力減衰器５０の減衰量を減少する方向に減衰レンジを設定制御する粗調整の手段を具備し、上述で得た減衰レンジ及び前後の減衰レンジにおいて、被測定信号１０１のパワー測定帯域を含む区間を周波数変換部６０で周波数掃引して被測定信号１０１の電力を各々測定算出し、この測定電力値から最適な減衰レンジに設定制御する最適調整の手段を具備し、上記減衰レンジの設定に連動して中間周波数の可変ゲインアンプ７２のゲインを制御して測定系全体のゲインを所定の状態にゲイン制御する手段を具備する構成手段がある。上述粗調整と最適調整の手段により、広帯域に分布した被測定周波数信号に対しても入力レベルの最適化を実現可能としたスペクトラムアナライザが実現できる。

【００１０】第３図と第６図（ｂ）は、本発明の変調解析装置に係る解決手段を示している。第３に、上記課題を解決するために、本発明の構成では、未知電力の被測定信号１０１を受けて、入力減衰器５０により減衰させ、減衰した未知電力減衰信号５１を受けて周波数変換部６０で所定の中間周波数ＩＦ１に周波数変換し、これをＩＦフィルタ７０によりフィルタし、変調解析部８０に供給して変調解析を行う変調解析装置において、周波数変換部６０は周波数を非掃引（ゼロスパンモード）とし、変調解析部８０内の周波数変換部８２で更に低い第２の中間周波数信号ＩＦ２に変換した信号を受けて、第２の中間周波数信号ＩＦ２の３次高調波成分まで信号処理可能な高速ＡＤ変換器９４を用いてデジタルデータに変換して第２の中間周波数信号ＩＦ２の３次高調波成分を測定する手段を具備し、前記３次高調波成分の測定手段により上記入力減衰器５０の減衰レンジの減衰量を順次変えて各々３次高調波成分を測定する手段を具備し、前記で得た３次高調波成分の各減衰レンジ毎の値を受けて、３次高調波成分が増加に転ずる減衰レンジを特定し、これから入力減衰器５０の減衰レンジを最適レンジに設定する手段を具備し、上記最適レンジ設定に連動して中間周波数の可変ゲインアンプ７２のゲインを制御して測定系全体のゲインを所定の状態にゲイン制御する手段を具備する構成手段がある。上述手法により、第２の中間周波数信号ＩＦ２の３次高調波が増加に転ずる推移が検出可能となる結果、広帯域に分布した被測定周波数信号においても入力レベルの最適化を実現可能とした変調解析装置が実現できる。

【００１１】第８図は、本発明のスペクトラムアナライザに係る解決手段を示している。第４に、上記課題を解決するために、本発明の構成では、未知電力の被測定信号１０１を受けて、入力減衰器５０により減衰させ、減衰した未知電力減衰信号５１を受けて周波数変換部６０で所定の中間周波数ＩＦ１に周波数変換し、これをＩＦフィルタ７０によりフィルタして測定するスペクトラムアナライザにおいて、周波数変換部６０は周波数を非掃引（ゼロスパンモード）とし、変調解析部８０内の周波数変換部８２で更に低い第２の中間周波数信号ＩＦ２に変換した信号を受けて、第２の中間周波数信号ＩＦ２の３次高調波成分まで信号処理可能な高速ＡＤ変換器９４を用いてデジタルデータに変換して第２の中間周波数信号ＩＦ２の３次高調波成分を測定する手段を具備し、前記３次高調波成分の測定手段により入力減衰器５０の減衰レンジの減衰量を順次変えて３次高調波成分を各々測定する手段を具備し、前記で得た３次高調波成分の各減衰レンジ毎の値を受けて、３次高調波成分が増加に転ずる減衰レンジを特定し、これから入力減衰器５０の減衰レンジを最適レンジに設定する手段を具備し、上記最適レンジ設定に連動して中間周波数の可変ゲインアンプ７２のゲインを制御して測定系全体のゲインを所定の状態にゲイン制御する手段を具備する構成手段がある。上述手法により、第２の中間周波数信号ＩＦ２の３次高調波が増加に転ずる推移が検出可能となる結果、広帯域に分布した被測定周波数信号においても入力レベルの最適化を実現可能としたスペクトラムアナライザが実現できる。

【００１２】

【発明の実施の形態】以下に本発明の実施の形態を実施例と共に図面を参照して詳細に説明する。

【００１３】（実施例１）本発明実施例について図１の変調解析装置の構成図を示して説明する。尚、従来構成に対応する要素は同一符号を付す。本発明では第１段階では入力減衰器５０により減衰された未知電力減衰信号５１を直接測定して減衰レンジを粗調整し、第２段階では被測定信号１０１のパワー測定帯域を含む周波数区間を周波数変換部６０で周波数掃引して電力を測定し、これに基づき最終的に入力減衰器５０を最適レンジに設定制御する。

【００１４】構成は、図１に示すように従来構成要素に対して、高周波増幅器２０と、検波部２５と、切替器８６とを追加した構成で成る。第１段階の粗調整における変調解析の測定に先立って、以下に説明する手段により入力減衰器５０の減衰量設定の適正化を行う。このとき切替器８６は検波部２５側に切替えておく。

【００１５】高周波増幅器２０は、入力減衰器５０で減衰されＬＰＦ（ローパスフィルタ）を通過した後の未知電力減衰信号５１を受けて、所定倍率に増幅して出力する。検波部２５は、これを受けて検波し、検波した直流電圧信号２６ｄｃを切替器８６を介してＡＤ変換器９０に供給する。そしてＡＤ変換器９０によりデジタル変換

した未知電力データDxを信号処理部９８へ供給する。

【００１６】信号処理部９８では、前記未知電力データDxを受けて、予め決めておいた上限レベルデータDlmtと比較して過大入力状態か否かを判定し、この判定結果により入力減衰器５０の減衰レンジを適正値に切替え制御する。尚、上記上限レベルデータDlmtは、周波数変換部６０のミキサ回路のばらつきを考慮し、裕度を持たせた最大許容入力レベルを上限レベルデータDlmtとするが、所望により個々の機器毎にミキサ回路の許容入力レベルを各々求め、これを上限レベルデータDlmtとして使用しても良い。

【００１７】上記の減衰レンジの適正化制御において、第１に、もし測定された未知電力データDxの値が上限レベルデータDlmtより大きい場合には、過大入力レベルであるから、入力減衰器５０の減衰量を増加する方向に減衰レンジを切替え制御し、この切替えに連動して中間周波数の可変ゲインアンプ７２のゲインを増加させ、測定系全体のゲインを当初の所定増幅度となるように設定制御する。第２に、もし未知電力データDxの値が上限レベルデータDlmtから所定レベル（例えば１０dB）以上低い値の場合には、微少入力レベルであるから、入力減衰器５０の減衰量を減少する方向に減衰レンジを切替え制御し、この切替えに連動して中間周波数の可変ゲインアンプ７２のゲインを減少させ、測定系全体のゲインを当初の所定増幅度となるように設定制御する。これにより未知電力減衰信号５１は適正化される。

【００１８】上述検波部２５のみの手段では必ずしも適正ではない場合がある。この為測定装置の電力測定機能を利用して第２段階の最適調整を行う。この第２段階の最適調整は、測定対象とする信号の電力値を測定して最適調整を実施する。即ち、被測定信号１０１のパワー測定帯域を含む周波数区間を周波数変換部６０で周波数掃引して電力を測定し、この電力測定を入力減衰器５０の減衰レンジを上述第１段階の粗調整で得た減衰レンジの設定状態から増減して減衰レンジを最適レンジに調整制御する。

【００１９】具体的には、図１０の周波数スペクトラムからのパワー測定例に示すように、一般的なパワー測定アプリケーションを用いてこの区間のパワーを積分して電力を算出する。例えばスペクトラム表示画面上において周波数軸を１１分割し、この分割中で、被測定信号１０１の中心周波数fcを６／１１の位置にくるように測定系の中心周波数を制御し、かつ４／１１～８／１１区間の位置に被測定信号１０１の帯域成分が収まるように掃引スパンを自動制御する。そしてこの区間のパワーを積分して電力を得る。この電力測定で得た結果から被測定信号の電力が得られ、上述第１段階による減衰レンジをもとに該減衰レンジの設定に連動して中間周波数の可変ゲインアンプのゲインを制御して測定系全体のゲインを所定の状態にすることで歪みを生じない減衰レンジに最適制御可能となる。この結果、周波数変換歪みが無く、S／Nが良く、測定精度の良い減衰レンジの自動制御が可能となる利点が得られる。

【００２０】上述適正化を実施の後、切替器８６を変調解析側に切替えて本来の変調解析を実施する。尚、この減衰量設定の適正化実施は、所望により変調解析測定の合間、あるいは減衰量設定の適正化の実行を起動するキー入力を受けた都度、あるいは随時実行するようにしても良い。

【００２１】上述発明の構成によれば、入力減衰器５０により減衰された未知電力減衰信号５１を直接測定して概略の減衰レンジを特定し、更にパワー測定アプリケーションを用いて被測定信号の電力を各々測定し、この結果をもとに測定系全体のゲインを所定の状態にするため、周波数変換部６０のミキサ入力端は適正な入力レベルに制御可能となるので、広帯域に分布した被測定周波数信号においても入力レベルの適正化が的確容易に実現できることとなる。従って、被測定信号が歪んで変調解析の誤差要因や電力測定の誤差要因を生じる難点が解消できる大きな利点が得られる。

【００２２】（実施例２）本発明実施例について図３の変調解析装置の構成図を示して説明する。尚、従来構成に対応する要素は同一符号を付す。本発明では周波数変換部６０は周波数を非掃引（ゼロスパンモード）としておき、中間周波数信号ＩＦ２の３次高調波成分まで信号処理可能な高速ＡＤ変換器９４を用いてデジタルデータに変換して第２の中間周波数信号ＩＦ２の３次高調波成分を検出測定することで、得られた前記３次高調波成分が増加に転ずる減衰レンジを特定し、これから入力減衰器５０を最適レンジに設定制御する手法である。

【００２３】構成は、図３に示すように従来構成要素に対して、変調解析部８０内にＬＰＦ９２と、高速ＡＤ変換器９４とを追加した構成で成る。

【００２４】実施例１と同様に、変調解析の測定に先立って、以下に説明する手段により入力減衰器５０の減衰量設定の適正化を行う。但し、予め被測定信号１０１の変調解析対象となる基本周波数は得ておく。先ず周波数変換部６０はゼロスパンモードとして周波数を非掃引にする。この状態で周波数変換部８２が出力する中間周波数信号ＩＦ２の基本波成分と３次高調波成分を測定する。例えば中間周波数信号ＩＦ２を２０ＭＨｚと仮定すると基本波成分は２０ＭＨｚで３次高調波成分は６０ＭＨｚである。この３次高調波成分を含んだ交流信号を高速ＡＤ変換器９４でデジタルデータに変換し、このデータをＦＦＴ処理して被測定信号１０１の基本波成分と３次高調波成分の差を求める。この基本波成分と３次高調波成分の差の測定処理を入力減衰器５０の減衰レンジを順次切替えて実施する。これらの測定結果を、図６（ｂ）の３次高調波レベルの推移例に示す。この推移図ではポイント３０１が増加に転じ始めていることが判

る。この判定結果により、入力減衰器５０の最適設定すべき減衰レンジはポイント３００として容易に求まる。そしてこの減衰レンジの設定に連動して、実施例１と同様に中間周波数の可変ゲインアンプ７２のゲインを増減させて、測定系全体のゲインを当初の所定増幅度となるように設定制御することは言うまでもない。これにより周波数変換部６０のミキサ回路への入力は最適な入力レベルに設定制御される。

【００２５】上述発明の構成によれば、入力減衰器５０の減衰レンジを順次変えて、被測定信号１０１を周波数変換した中間周波数信号ＩＦ２の基本波成分と３次高調波成分の差を求め、この基本波成分と３次高調波の差レベルの推移が増加に転じる減衰レンジを特定することで、最適な減衰レンジが検出可能となる結果、被測定信号が歪んで変調解析の誤差要因や電力測定の誤差要因を生じる難点が解消できる大きな利点が得られる。

【００２６】尚、上述実施例１では、図１に示す変調解析装置の具体構成例により、入力減衰器５０の出力端の未知電力減衰信号５１のレベルを直接測定する構成例としていたが、所望により図２に示すように、高周波増幅器２０と検波部２５と切替器３０とによって未知電力減衰信号５１のレベルを直接測定する構成としても良く、同様にして実施可能である。

【００２７】尚、上述実施例２では、図３に示す変調解析装置の具体構成例により、３次高調波成分を測定する構成例としていたが、所望により図９に示すように、中間周波数信号における一次レベル信号のみを通過させるＢＰＦ（バンドパスフィルタ）を設けてフィルタし、これを検波してレベルを測定し、更に中間周波数信号における三次レベル信号のみを通過させるＢＰＦ（バンドパスフィルタ）を設けてフィルタし、これを検波してレベルを測定し、前記測定を減衰レンジを順次変えて一次レベル信号と三次レベル信号の両者を求め、これから一次と三次レベルとの差レベルが増加に転ずる減衰レンジが特定できるので、同様にして入力減衰器５０の減衰レンジを適正化制御する構成手段としても良い。

【００２８】尚、上述実施例１の説明では、変調解析装置に適用した具体例で説明していたが、図４に示すように、高周波増幅器２０と検波部２５と切替器３０を追加したスペクトラムアナライザの構成とし、同様に入力減衰器５０により減衰された未知電力減衰信号５１のレベルを直接測定して減衰レンジを最適化制御することで、同様にして入力レベルの最適化を実現可能であることは明白である。

【００２９】尚、上述実施例２においても、変調解析装置に適用した具体例で説明していたが、図８に示すように、従来のスペクトラムアナライザの構成においても、周波数変換部８２とＬＰＦ９２と高速ＡＤ変換器９４を設けて、上述実施例２の手法である基本波成分と３次高調波成分との差を順次測定し、得た基本波成分と３次高調波成分との差から増加に転ずる減衰レンジを特定して、入力減衰器５０を適正化制御する手法を設けることにより実現可能である。

【００３０】尚、上述実施例１では、図１あるいは図３に示す変調解析装置の具体構成例で説明していたが、所望により図７に示すように、両方の制御手段を併用する構成としても良い。即ち、未知電力減衰信号５１を直接測定し、この測定結果に基づき入力減衰器５０と中間周波数の可変ゲインアンプ７２を適正に制御した後、更に基本波成分と３次高調波を測定して基本波成分と３次高調波との差が増加に転ずる推移を検出して、最適な入力減衰器５０の設定に制御する両手法を併用する構成である。

【００３１】

【発明の効果】本発明は、上述の説明内容から、下記に記載される効果を奏する。第１に、上述実施例１の発明構成によれば、入力減衰器５０により減衰された未知電力減衰信号５１を直接測定して概略の減衰レンジを特定し、更にパワー測定アプリケーションを用いて被測定信号の電力を各々測定し、この結果をもとに測定系全体のゲインを所定の状態にすることで周波数変換部６０のミキサ入力端を適正な入力レベルに制御可能となるので、広帯域に分布した被測定周波数信号においても入力レベルの適正化が的確容易に実現できることとなる。従って、被測定信号が歪んで変調解析の誤差要因や電力測定の誤差要因を生じる難点が解消できる大きな利点が得られる。また、スペクトラムアナライザの構成の場合も、同様にして入力レベルの適正化の利点が得られる。

【００３２】第２に、上述実施例２の発明構成によれば、入力減衰器５０の減衰レンジを順次変えて、被測定信号１０１を周波数変換した中間周波数信号ＩＦ２の基本波成分と３次高調波成分との差を求め、この基本波成分と３次高調波との差レベルの推移が増加に転じる減衰レンジを特定することで、最適な減衰レンジが検出可能となる結果、被測定信号が歪んで変調解析の誤差要因や電力測定の誤差要因を生じる難点が解消できる大きな利点が得られる。また、スペクトラムアナライザの構成の場合も、同様にして入力レベルの適正化の利点が得られる。

【図面の簡単な説明】

【図１】　本発明の、変調解析装置の構成例である。

【図２】　本発明の、変調解析装置の他の構成例である。

【図３】　本発明の、変調解析装置の他の構成例である。

【図４】　本発明の、スペクトラムアナライザの構成例である。

【図５】　従来の、変調解析装置の構成例である。

【図６】　広帯域に分布する周波数信号例と、基本波と３次高調波との差のレベルの推移例である。

【図７】 本発明の、変調解析装置の他の構成例である。

【図８】 本発明の、スペクトラムアナライザの他の構成例である。

【図９】 本発明の、変調解析装置の他の構成例である。

【図１０】 本発明の、周波数スペクトラムからのパワー測定例である。

【符号の説明】

２０ 高周波増幅器

２５，７６ 検波部

３０，８６ 切替器 ＊

＊５０ 入力減衰器

６０，８２ 周波数変換部

７０ ＩＦフィルタ

７２，８４ 可変ゲインアンプ

７４ 対数変換部

７８，９０ ＡＤ変換器

８０ 変調解析部

９４ 高速ＡＤ変換器

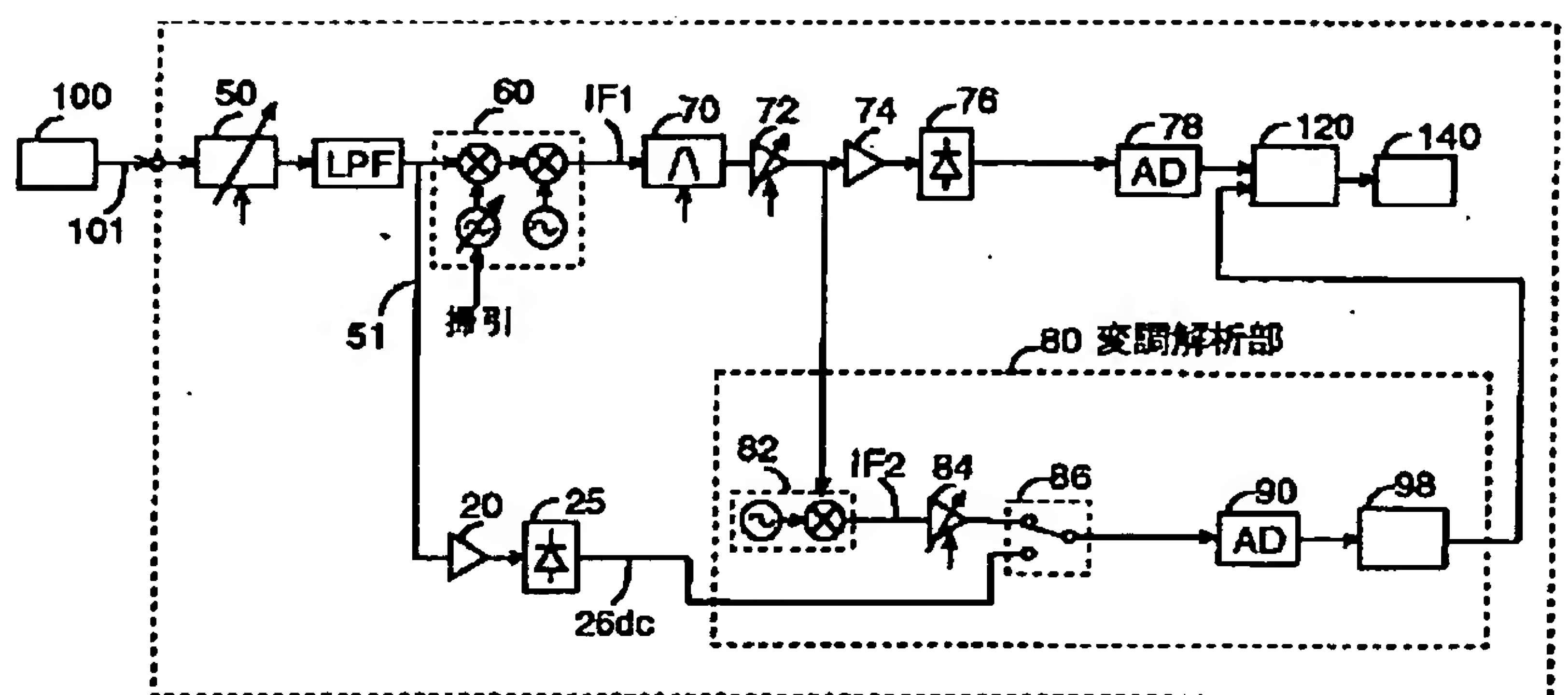
１４０ 表示装置

９８ 信号処理部

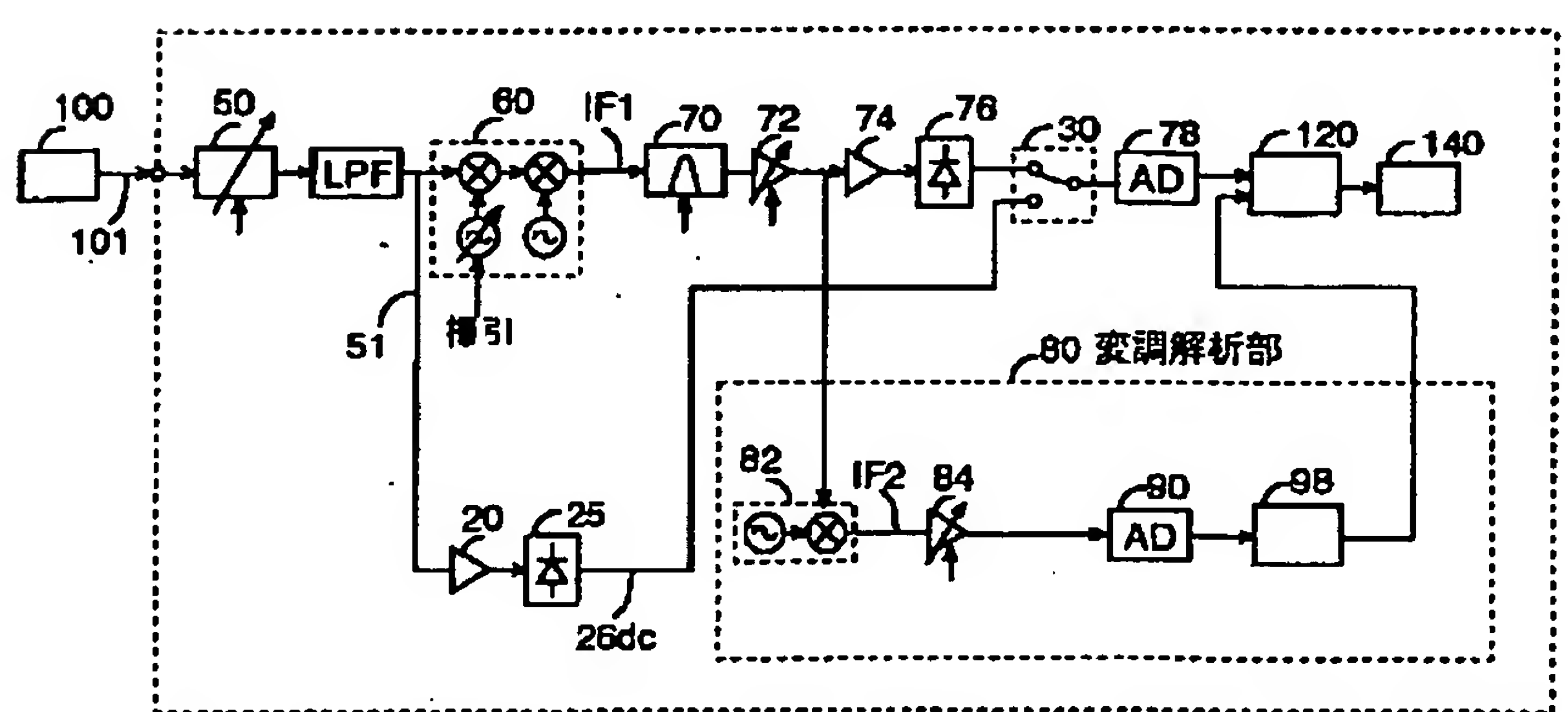
１００ 被試験装置

＊ １２０ 表示処理部

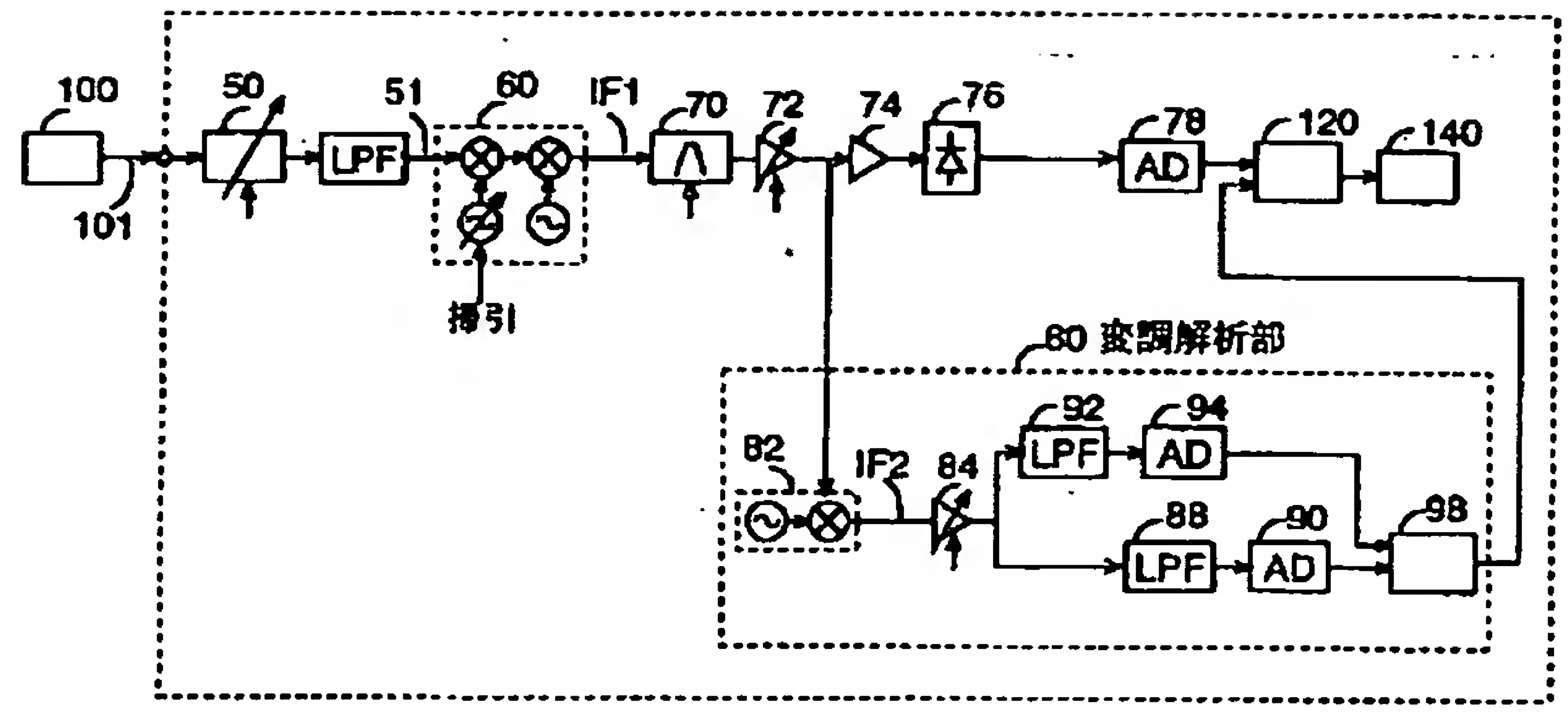
【図１】



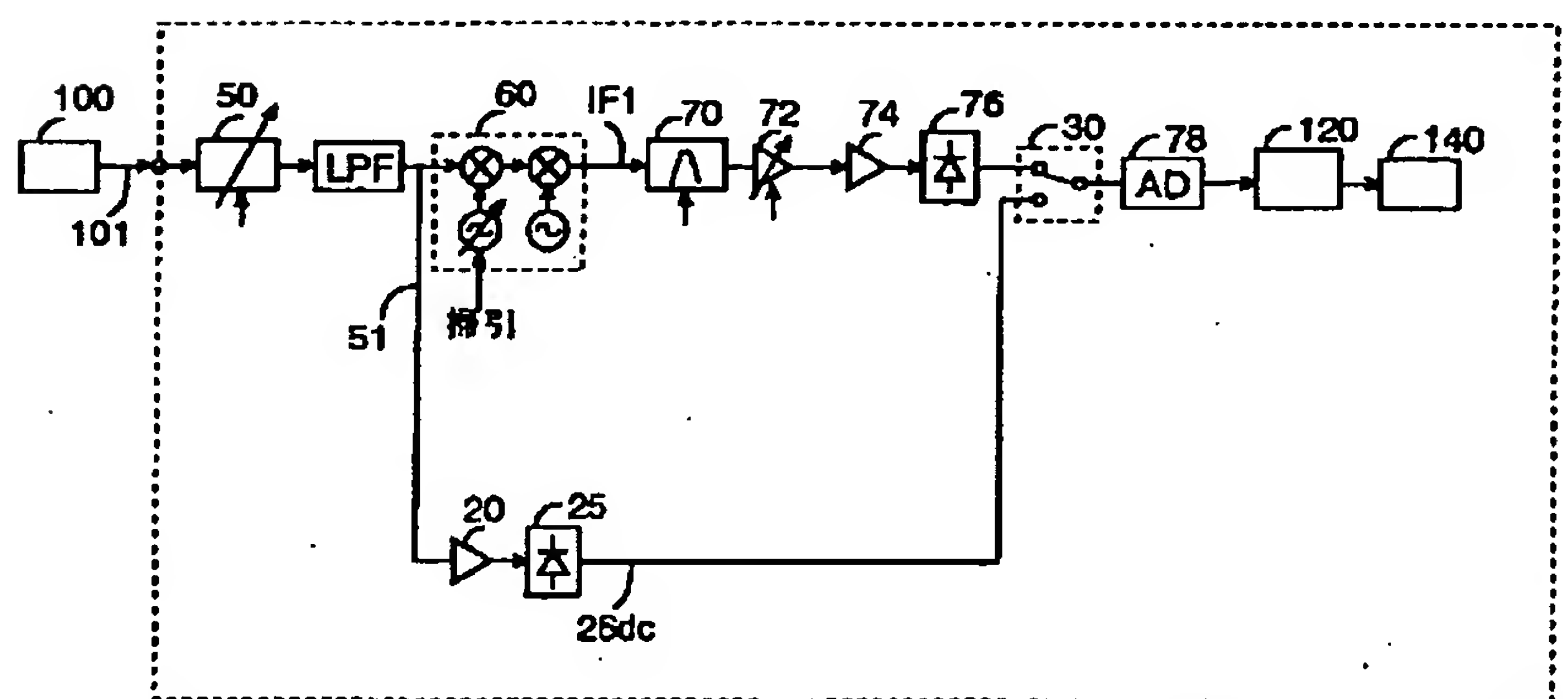
【図２】



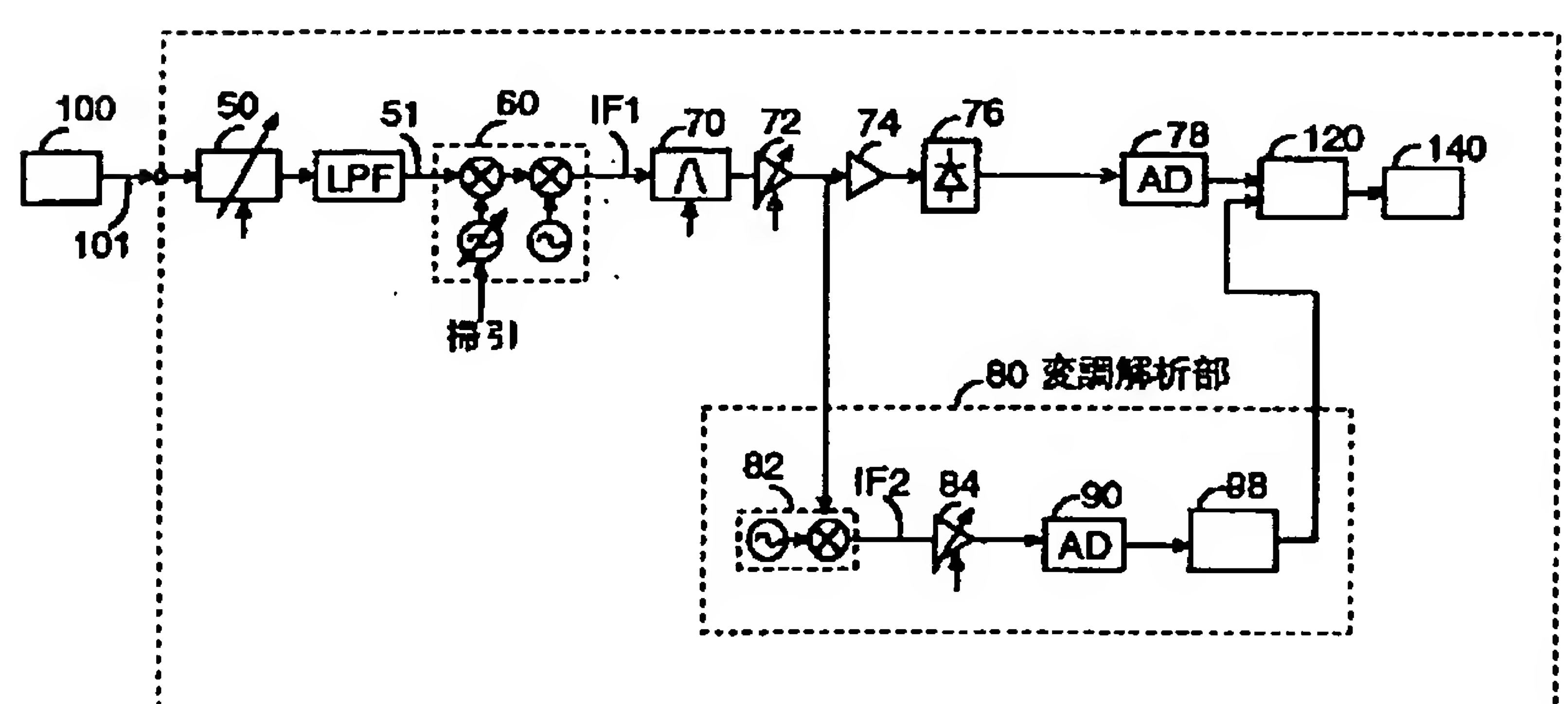
【図３】


100
101
50
LPF
51
60
掃引
IF1
70
72
74
76
78
AD
120
140
80 変調解析部
82
IF2
84
92
LPF
94
AD
88
LPF
90
AD
98

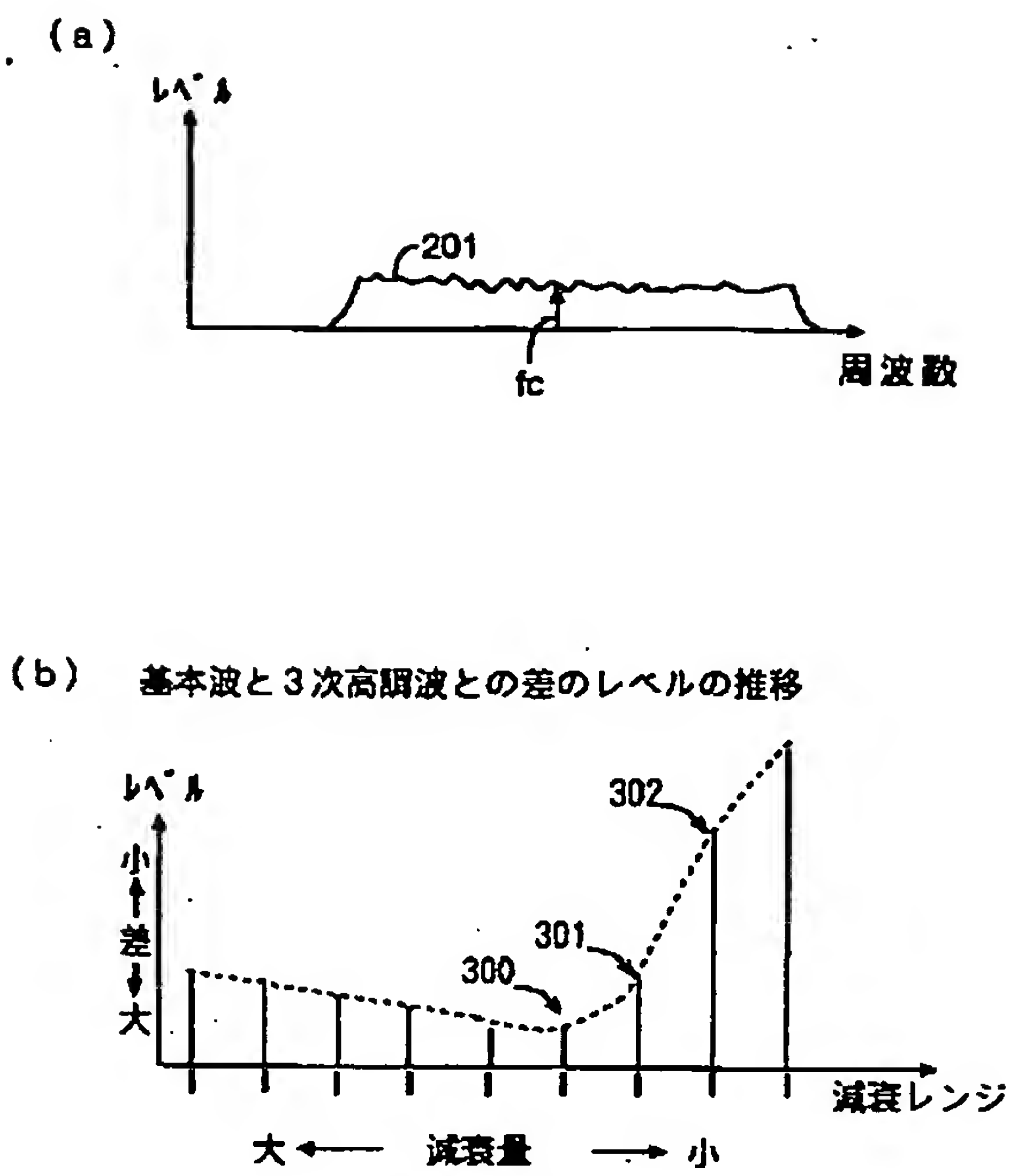
【図４】


100
101
50
LPF
60
掃引
51
IF1
70
72
74
76
30
78
AD
120
140
20
25
26dc

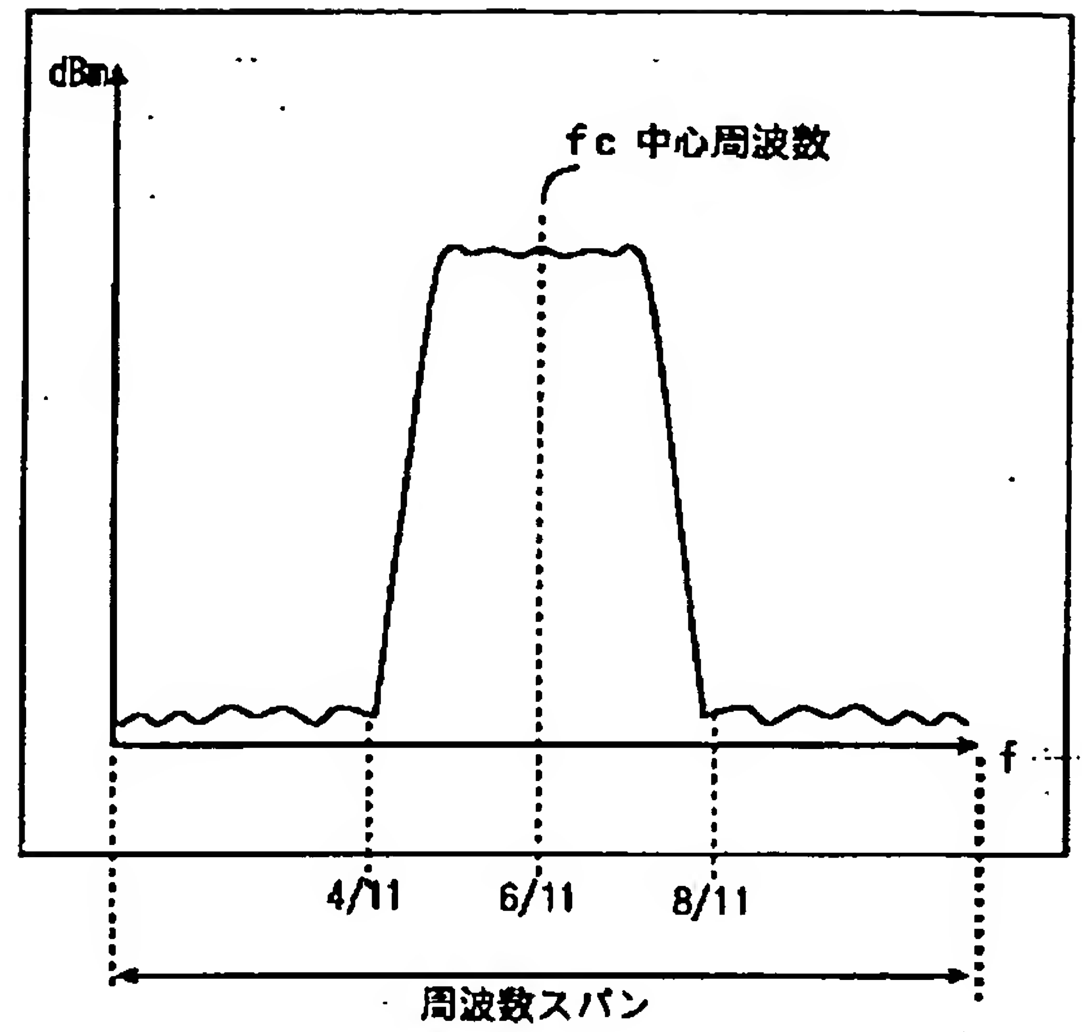
【図５】


100
101
50
51
LPF
60
掃引
IF1
70
72
74
76
78
AD
120
140
80 変調解析部
82
IF2
84
90
AD
98

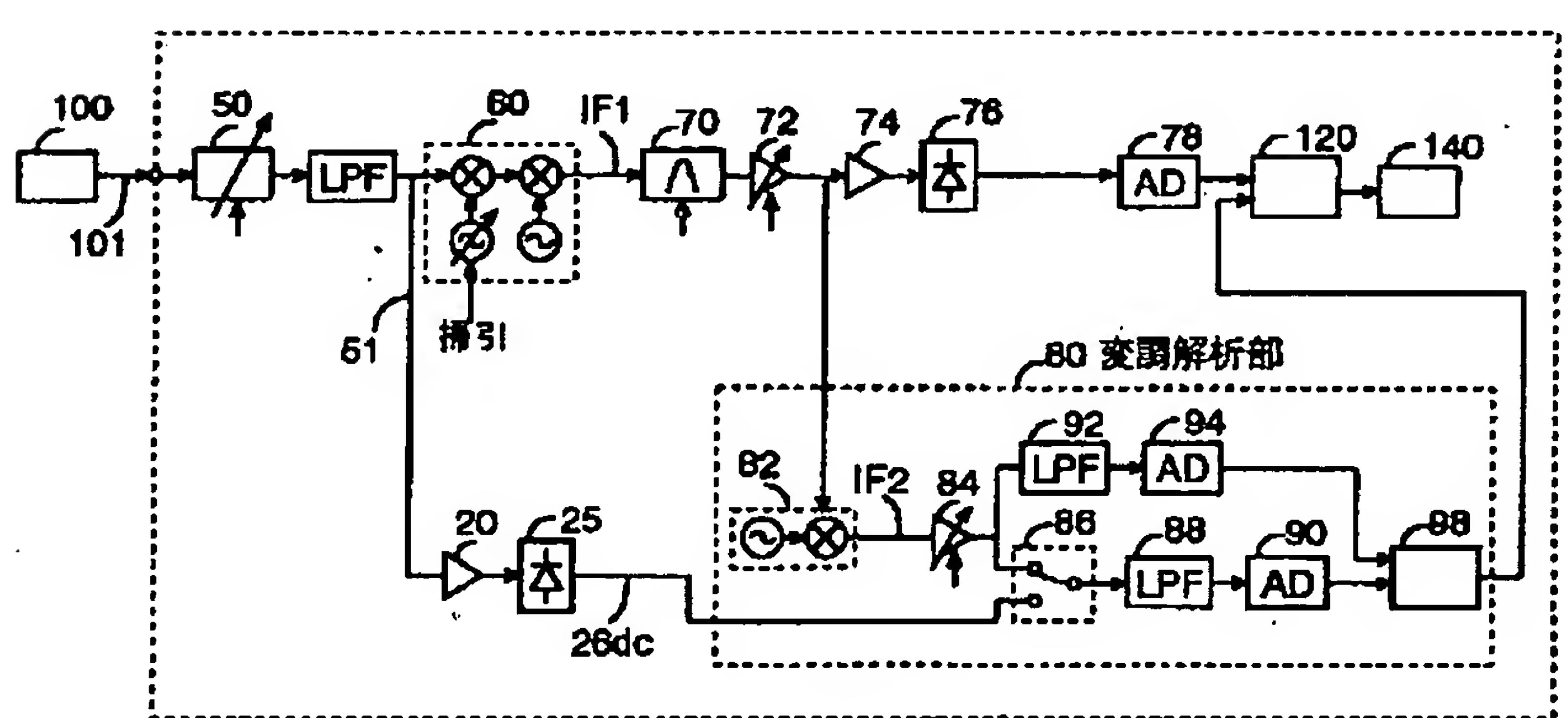
【図６】


(a)
レベル
201
fc
周波数
(b)　基本波と３次高調波との差のレベルの推移
レベル
小
差
大
302
301
300
減衰レンジ
大
減衰量
小

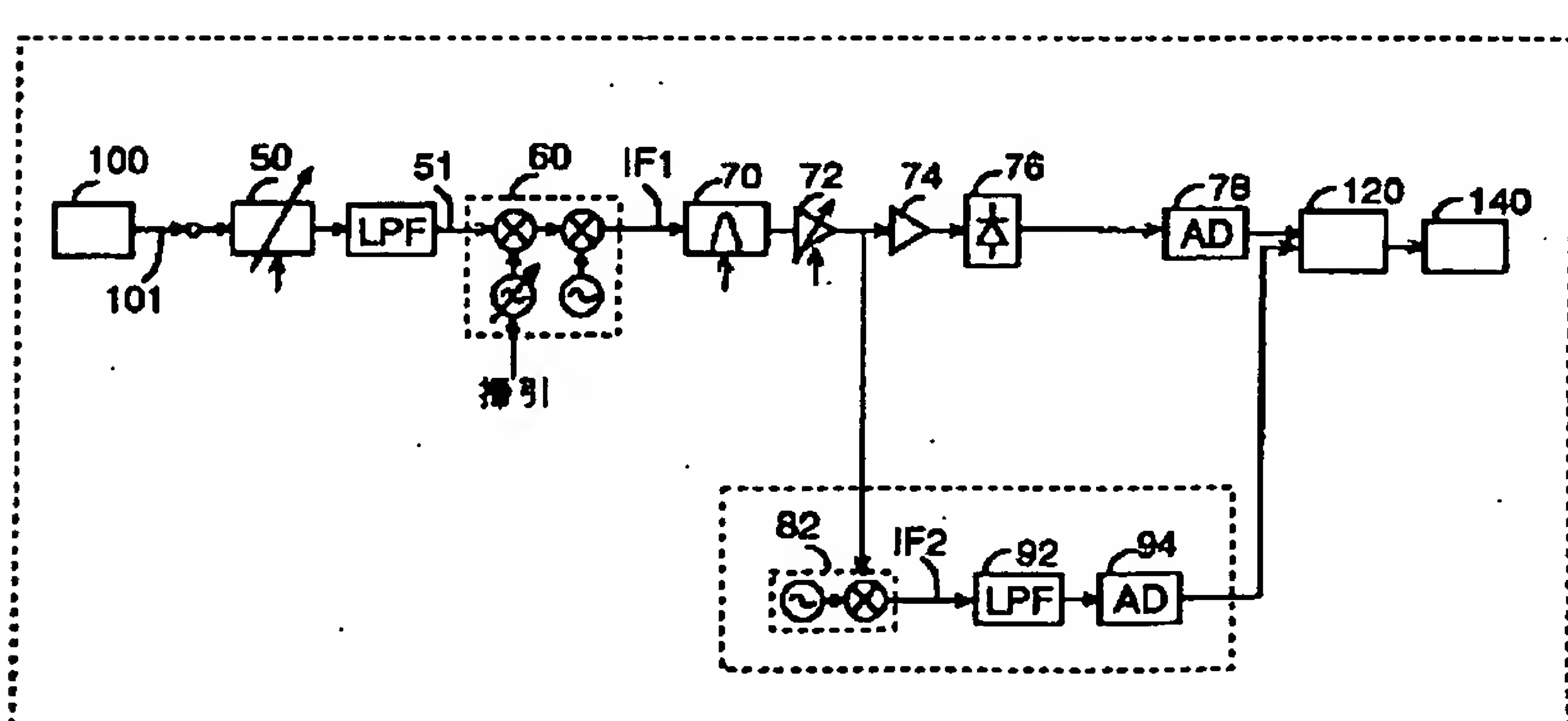
【図１０】


dBm
fc 中心周波数
f
4/11
6/11
8/11
周波数スパン

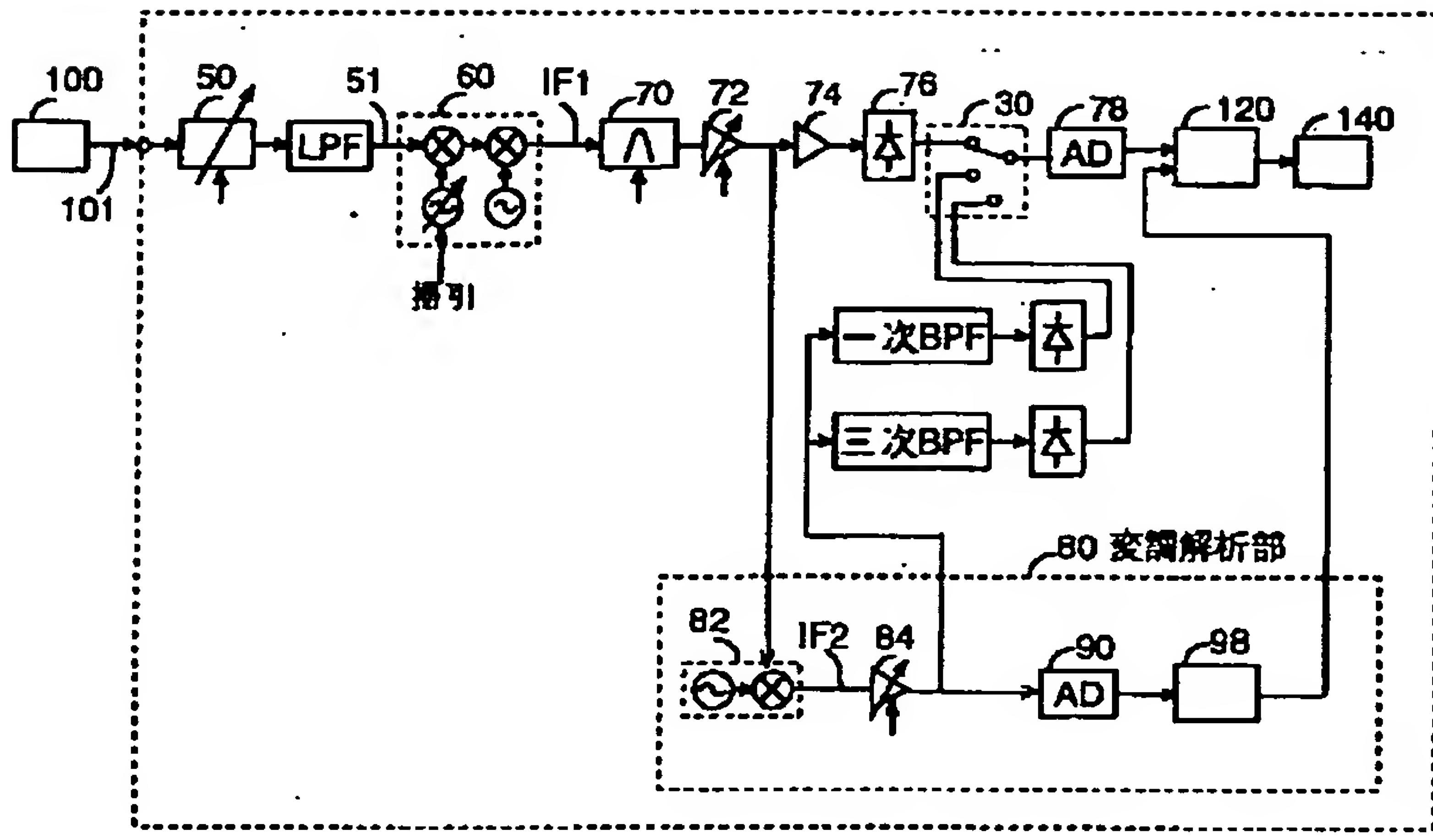
【図７】


100
101
50
LPF
60
IF1
70
72
74
76
78
AD
120
140
51
掃引
80 変調解析部
82
IF2
84
92
LPF
94
AD
86
88
LPF
90
AD
98
20
25
26dc

【図８】


100
101
50
LPF
51
60
IF1
70
72
74
76
78
AD
120
140
掃引
82
IF2
92
LPF
94
AD

【図９】



【手続補正書】
【提出日】平成９年１０月６日
【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】全文
【補正方法】変更
【補正内容】
【書類名】　明細書
【発明の名称】　変調解析装置及びスペクトラムアナライザ
【特許請求の範囲】
【請求項１】　未知電力の被測定信号を受けて、入力減衰器により減衰させ、減衰した未知電力減衰信号を受けて周波数変換部で所定の中間周波数に周波数変換し、これをＩＦフィルタによりフィルタし、変調解析部に供給して変調解析を行う変調解析装置において、
該入力減衰器によって減衰した未知電力減衰信号を受けて、該信号を増幅し検波して該入力減衰器の出力端における未知電力レベルを検出する手段と、
第１に該未知電力検出手段で得た電力レベル値が所定上限値より高い場合は該入力減衰器の減衰量を増加する方向に減衰レンジを設定制御し、第２に該未知電力検出手段で得た電力レベル値が所定下限値より低い場合は該入力減衰器の減衰量を減少する方向に減衰レンジを設定制御する手段と、
上述で得た減衰レンジ及び前後の減衰レンジにおいて、被測定信号のパワー測定帯域を含む区間を周波数変換部で周波数掃引して被測定信号の電力を各々測定算出し、この測定電力値をもとに最適な減衰レンジに設定制御する手段と、
該減衰レンジの設定に連動して中間周波数の可変ゲインアンプのゲインを制御して測定系全体のゲインを所定の状態にゲイン制御する手段と、
以上を具備していることを特徴とした変調解析装置。
【請求項２】　未知電力の被測定信号を受けて、入力減衰器により減衰させ、減衰した未知電力減衰信号を受けて周波数変換部で所定の中間周波数に周波数変換し、これをＩＦフィルタによりフィルタして測定するスペクトラムアナライザにおいて、
該入力減衰器によって減衰した未知電力減衰信号を受けて、該信号を増幅し検波して該入力減衰器の出力端における未知電力レベルを検出する手段と、
第１に該未知電力検出手段で得た電力レベル値が所定上限値より高い場合は該入力減衰器の減衰量を増加する方向に減衰レンジを設定制御し、第２に該未知電力検出手段で得た電力レベル値が所定下限値より低い場合は該入力減衰器の減衰量を減少する方向に減衰レンジを設定制御する手段と、
上述で得た減衰レンジ及び前後の減衰レンジにおいて、被測定信号のパワー測定帯域を含む区間を周波数変換部で周波数掃引して被測定信号の電力を各々測定算出し、この測定電力値をもとに最適な減衰レンジに設定制御する手段と、
該減衰レンジの設定に連動して中間周波数の可変ゲインアンプのゲインを制御して測定系全体のゲインを所定の状態にゲイン制御する手段と、
以上を具備していることを特徴としたスペクトラムアナライザ。
【請求項３】　未知電力の被測定信号を受けて、入力減衰器により減衰させ、減衰した未知電力減衰信号を受けて周波数変換部で所定の中間周波数に周波数変換し、こ

れをＩＦフィルタによりフィルタし、変調解析部に供給して変調解析を行う変調解析装置において、
周波数変換部は周波数を非掃引とし、変調解析部内の周波数変換部で更に低い第２の中間周波数信号に変換した信号を受けて、該第２の中間周波数信号の３次高調波成分まで信号処理可能な高速ＡＤ変換器を用いてデジタルデータに変換して該第２の中間周波数信号の基本波成分と３次高調波成分を測定する手段と、
前記３次高調波成分の測定手段により該入力減衰器の減衰レンジの減衰量を順次変えて各々基本波成分と３次高調波成分を測定する手段と、
前記で得た３次高調波成分の各減衰レンジ毎の値を受けて、３次高調波成分との差が増加に転ずる減衰レンジを特定し、これから入力減衰器の減衰レンジを最適レンジに設定する手段と、
該最適レンジ設定に連動して中間周波数の可変ゲインアンプのゲインを制御して測定系全体のゲインを所定の状態にゲイン制御する手段と、
以上を具備していることを特徴とした変調解析装置。
【請求項４】　未知電力の被測定信号を受けて、入力減衰器により減衰させ、減衰した未知電力減衰信号を受けて周波数変換部で所定の中間周波数に周波数変換し、これをＩＦフィルタによりフィルタして測定するスペクトラムアナライザにおいて、
周波数変換部は周波数を非掃引とし、変調解析部内の周波数変換部で更に低い第２の中間周波数信号に変換した信号を受けて、該第２の中間周波数信号の３次高調波成分まで信号処理可能な高速ＡＤ変換器を用いてデジタルデータに変換して該第２の中間周波数信号の基本波成分と３次高調波成分を測定する手段と、
前記３次高調波成分の測定手段により該入力減衰器の減衰レンジの減衰量を順次変えて基本波成分と３次高調波成分を各々測定する手段と、
前記で得た３次高調波成分の各減衰レンジ毎の値を受けて、３次高調波成分との差が増加に転ずる減衰レンジを特定し、これから入力減衰器の減衰レンジを最適レンジに設定する手段と、
該最適レンジ設定に連動して中間周波数の可変ゲインアンプのゲインを制御して測定系全体のゲインを所定の状態にゲイン制御する手段と、
以上を具備していることを特徴としたスペクトラムアナライザ。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】この発明は、被測定周波数信号の入力レベルの最適化に関する。特にスペクトラム拡散された広帯域に分布する被測定周波数信号の入力レベルの最適化に関する。
【０００２】
【従来の技術】従来技術例について図５の変調解析装置の構成図を示して説明する。この変調解析装置は、スペクトラムアナライザを基本構成にし、この中間周波数信号（ＩＦ信号）を受けて、被測定信号の各種変調に関わる解析機能を付加した構成例である。
【０００３】構成は、被試験装置１００と、入力減衰器５０と、周波数変換部６０と、ＩＦフィルタ７０と、可変ゲインアンプ７２と、対数変換部７４と、検波部７６と、ＡＤ変換器７８と、変調解析部８０と、表示処理部１２０と、表示装置１４０とで成る。尚、スペクトラムアナライザの構成は技術的に良く知られている為説明を省略する。
【０００４】変調解析部８０の内部構成は、周波数変換部８２と、可変ゲインアンプ８４と、ＡＤ変換器９０と、信号処理部９８とで成る。この変調解析部は、周波数変換部８２により数ＭＨｚの低い中間周波数信号ＩＦ２に変換し、可変ゲインアンプ８４でＡＤ変換器９０の最適レベルに増幅した中間周波数信号をＡＤ変換器９０で高速サンプリングし、信号処理して各種の変調特性等の解析や変調精度に係る測定と演算処理をするものである。処理された結果は表示処理部１２０を介して表示装置１４０で所望の表示をする。
【０００５】ところで変調測定に際して表示装置１４０の管面上の表示レベルを使用者が定める必要がある。この管面レベルを設定する一手順を説明する。ここで被試験装置１００が出力する被測定信号１０１は、図６（ａ）に示す周波数信号２０１のように、ＣＤＭＡ（Code Division Multiple Access）等の広帯域に分布するスペクトラム拡散された周波数信号の場合と仮定する。先ず図６（ａ）に示す中心周波数ｆc付近に設定し、ゼロスパン・モード（周波数を掃引しないモード）で入力レベルを管面表示させる。そしてキー入力設定により、スペクトラムレベルが大きく見易くなる所望の入力感度及びリファレンスレベルに設定する。この設定の結果入力減衰器５０とＩＦ信号用の可変ゲインアンプ７２は所定の減衰量及び増幅量に自動設定される。尚、入力減衰器５０は例えば１０ｄＢステップの減衰器であり、可変ゲインアンプ７２は例えば０．１ｄＢ／Div. ステップの細かな可変増幅器である。
【０００６】
【発明が解決しようとする課題】ところで、図６（ａ）に示すように、広帯域に分散した周波数信号２０１の為、各周波数点でのレベルは低い。この為、上述管面表示レベルの設定に伴って、入力減衰器５０の設定は小さい減衰量になっている。しかしながら広帯域に拡散した全周波数の総電力は大きいレベルである。この結果、図５に示す入力減衰器５０で減衰した未知電力減衰信号５１は比較的大きなレベルである。この信号が周波数変換部６０のミキサ回路の入力端に供給される。この結果、ミキサ回路は過大な入力レベルとなる場合がある。もし過大入力レベルの場合は、被測定周波数信号が歪んでＮ-

次高調波を生じたり、周波数変換ゲインの直線性が大きく変わる等の不具合を生じる。これら不具合は、被試験装置の変調解析や電力測定の誤差を増長させる為、測定装置としては好ましくなく、実用上の難点がある。尚、図５に示す変調解析部８０を有しない一般的なスペクトラムアナライザにおいても広帯域に分布あるいは離散した未知電力の周波数信号等においては、同様の難点があることは言うまでもない。

【０００７】そこで、本発明が解決しようとする課題は、広帯域に分布あるいは離散した被測定周波数信号においても入力レベルの最適化を実現可能とした変調解析装置及びスペクトラムアナライザを提供することである。

【０００８】

【課題を解決するための手段】第１図あるいは第２図と第１０図は、本発明の変調解析装置に係る解決手段を示している。第１に、上記課題を解決するために、本発明の構成では、未知電力の被測定信号１０１を受けて、入力減衰器５０により減衰させ、減衰した未知電力減衰信号５１を受けて周波数変換部６０で所定の中間周波数ＩＦ１に周波数変換し、これをＩＦフィルタ７０によりフィルタし、変調解析部８０に供給して変調解析を行う変調解析装置において、入力減衰器５０によって減衰した未知電力減衰信号５１を受けて、この信号を増幅し検波して入力減衰器５０の出力端における未知電力レベルを検出する手段を具備し、第１に上記未知電力検出手段で得た電力レベル値が所定上限値より高い場合は入力減衰器５０の減衰量を増加する方向に減衰レンジを設定制御し、第２に上記未知電力検出手段で得た電力レベル値が所定下限値より低い場合は入力減衰器５０の減衰量を減少する方向に減衰レンジを設定制御する粗調整の手段を具備し、上述で得た減衰レンジ及び前後の減衰レンジにおいて、被測定信号１０１のパワー測定帯域を含む区間を周波数変換部６０で周波数掃引して被測定信号１０１の電力を各々測定算出し、この測定電力値から最適な減衰レンジに設定制御する最適調整の手段を具備し、上記減衰レンジの設定に連動して中間周波数の可変ゲインアンプ７２のゲインを制御して測定系全体のゲインを所定の状態にゲイン制御する手段を具備する構成手段である。上述粗調整と最適調整の手段により、広帯域に分布した被測定周波数信号に対しても入力レベルの最適化を実現可能とした変調解析装置が実現できる。

【０００９】第４図は、本発明のスペクトラムアナライザに係る解決手段を示している。第２に、上記課題を解決するために、本発明の構成では、未知電力の被測定信号１０１を受けて、入力減衰器５０により減衰させ、減衰した未知電力減衰信号５１を受けて周波数変換部６０で所定の中間周波数ＩＦ１に周波数変換し、これをＩＦフィルタ７０によりフィルタして測定するスペクトラムアナライザにおいて、入力減衰器５０によって減衰した未知電力減衰信号５１を受けて、この信号を増幅し検波して入力減衰器５０の出力端における未知電力レベルを検出する手段を具備し、第１に上記未知電力検出手段で得た電力レベル値が所定上限値より高い場合は入力減衰器５０の減衰量を増加する方向に減衰レンジを設定制御し、第２に上記未知電力検出手段で得た電力レベル値が所定下限値より低い場合は入力減衰器５０の減衰量を減少する方向に減衰レンジを設定制御する粗調整の手段を具備し、上述で得た減衰レンジ及び前後の減衰レンジにおいて、被測定信号１０１のパワー測定帯域を含む区間を周波数変換部６０で周波数掃引して被測定信号１０１の電力を各々測定算出し、この測定電力値から最適な減衰レンジに設定制御する最適調整の手段を具備し、上記減衰レンジの設定に連動して中間周波数の可変ゲインアンプ７２のゲインを制御して測定系全体のゲインを所定の状態にゲイン制御する手段を具備する構成手段である。上述粗調整と最適調整の手段により、広帯域に分布した被測定周波数信号に対しても入力レベルの最適化を実現可能としたスペクトラムアナライザが実現できる。

【００１０】第３図と第６図（ｂ）は、本発明の変調解析装置に係る解決手段を示している。第３に、上記課題を解決するために、本発明の構成では、未知電力の被測定信号１０１を受けて、入力減衰器５０により減衰させ、減衰した未知電力減衰信号５１を受けて周波数変換部６０で所定の中間周波数ＩＦ１に周波数変換し、これをＩＦフィルタ７０によりフィルタし、変調解析部８０に供給して変調解析を行う変調解析装置において、周波数変換部６０は周波数を非掃引（ゼロスパンモード）とし、変調解析部８０内の周波数変換部８２で更に低い第２の中間周波数信号ＩＦ２に変換した信号を受けて、第２の中間周波数信号ＩＦ２の３次高調波成分まで信号処理可能な高速ＡＤ変換器９４を用いてデジタルデータに変換して第２の中間周波数信号ＩＦ２の基本波成分と３次高調波成分を測定する手段を具備し、前記３次高調波成分の測定手段により上記入力減衰器５０の減衰レンジの減衰量を順次変えて各々基本波成分と３次高調波成分を測定する手段を具備し、前記で得た３次高調波成分の各減衰レンジ毎の値を受けて、３次高調波成分との差が増加に転ずる減衰レンジを特定し、これから入力減衰器５０の減衰レンジを最適レンジに設定する手段を具備し、上記最適レンジ設定に連動して中間周波数の可変ゲインアンプ７２のゲインを制御して測定系全体のゲインを所定の状態にゲイン制御する手段を具備する構成手段がある。上述手法により、第２の中間周波数信号ＩＦ２の基本波成分と３次高調波成分との差が増加に転ずる推移が検出可能となる結果、広帯域に分布した被測定周波数信号においても入力レベルの最適化を実現可能とした変調解析装置が実現できる。

【００１１】第８図は、本発明のスペクトラムアナライザに係る解決手段を示している。第４に、上記課題を解決するために、

決するために、本発明の構成では、未知電力の被測定信号101を受けて、入力減衰器50により減衰させ、減衰した未知電力減衰信号51を受けて周波数変換部60で所定の中間周波数ＩＦ１に周波数変換し、これをＩＦフィルタ70によりフィルタして測定するスペクトラムアナライザにおいて、周波数変換部60は周波数を非掃引（ゼロスパンモード）とし、変調解析部80内の周波数変換部82で更に低い第2の中間周波数信号ＩＦ２に変換した信号を受けて、第2の中間周波数信号ＩＦ２の3次高調波成分まで信号処理可能な高速ＡＤ変換器94を用いてデジタルデータに変換して第2の中間周波数信号ＩＦ２の基本波成分と3次高調波成分を測定する手段を具備し、前記3次高調波成分の測定手段により入力減衰器50の減衰レンジの減衰量を順次変えて基本波成分と3次高調波成分を各々測定する手段を具備し、前記で得た3次高調波成分の各減衰レンジ毎の値を受けて、3次高調波成分との差が増加に転ずる減衰レンジを特定し、これから入力減衰器50の減衰レンジを最適レンジに設定する手段を具備し、上記最適レンジ設定に連動して中間周波数の可変ゲインアンプ72のゲインを制御して測定系全体のゲインを所定の状態にゲイン制御する手段を具備する構成手段がある。上述手法により、第2の中間周波数信号ＩＦ２の基本波成分と3次高調波成分との差が増加に転ずる推移が検出可能となる結果、広帯域に分布した被測定周波数信号においても入力レベルの最適化を実現可能としたスペクトラムアナライザが実現できる。

【0012】

【発明の実施の形態】以下に本発明の実施の形態を実施例と共に図面を参照して詳細に説明する。

【0013】（実施例1）本発明実施例について図1の変調解析装置の構成図を示して説明する。尚、従来構成に対応する要素は同一符号を付す。本発明では第1段階では入力減衰器50により減衰された未知電力減衰信号51を直接測定して減衰レンジを粗調整し、第2段階では被測定信号101のパワー測定帯域を含む周波数区間を周波数変換部60で周波数掃引して電力を測定し、これに基づき最終的に入力減衰器50を最適レンジに設定制御する。

【0014】構成は、図1に示すように従来構成要素に対して、高周波増幅器20と、検波部25と、切替器86とを追加した構成で成る。第1段階の粗調整における変調解析の測定に先立って、以下に説明する手段により入力減衰器50の減衰量設定の適正化を行う。このとき切替器86は検波部25側に切替えておく。

【0015】高周波増幅器20は、入力減衰器50で減衰されＬＰＦ（ローパスフィルタ）を通過した後の未知電力減衰信号51を受けて、所定倍率に増幅して出力する。検波部25は、これを受けて検波し、検波した直流電圧信号26ｄｃを切替器86を介してＡＤ変換器90に供給する。そしてＡＤ変換器90によりデジタル変換した未知電力データD_xを信号処理部98へ供給する。

【0016】信号処理部98では、前記未知電力データD_xを受けて、予め決めておいた上限レベルデータD_{lmt}と比較して過大入力状態か否かを判定し、この判定結果により入力減衰器50の減衰レンジを適正値に切替え制御する。尚、上記上限レベルデータD_{lmt}は、周波数変換部60のミキサ回路のばらつきを考慮し、裕度を持たせた最大許容入力レベルを上限レベルデータD_{lmt}とするが、所望により個々の機器毎にミキサ回路の許容入力レベルを各々求め、これを上限レベルデータD_{lmt}として使用しても良い。

【0017】上記の減衰レンジの適正化制御において、第1に、もし測定された未知電力データD_xの値が上限レベルデータD_{lmt}より大きい場合には、過大入力レベルであるから、入力減衰器50の減衰量を増加する方向に減衰レンジを切替え制御し、この切替えに連動して中間周波数の可変ゲインアンプ72のゲインを増加させ、測定系全体のゲインを当初の所定増幅度となるように設定制御する。第2に、もし未知電力データD_xの値が上限レベルデータD_{lmt}から所定レベル（例えば10ｄＢ）以上低い値の場合には、微少入力レベルであるから、入力減衰器50の減衰量を減少する方向に減衰レンジを切替え制御し、この切替えに連動して中間周波数の可変ゲインアンプ72のゲインを減少させ、測定系全体のゲインを当初の所定増幅度となるように設定制御する。これにより未知電力減衰信号51は適正化される。

【0018】上述検波部25のみの手段では必ずしも適正ではない場合がある。この為測定装置の電力測定機能を利用して第2段階の最適調整を行う。この第2段階の最適調整は、測定対象とする信号の電力値を測定して最適調整を実施する。即ち、被測定信号101のパワー測定帯域を含む周波数区間を周波数変換部60で周波数掃引して電力を測定し、この電力測定を入力減衰器50の減衰レンジを上述第1段階の粗調整で得た減衰レンジの設定状態から増減して減衰レンジを最適レンジに調整制御する。

【0019】具体的には、図10の周波数スペクトラムからのパワー測定例に示すように、一般的なパワー測定アプリケーションを用いてこの区間のパワーを積分して電力を算出する。例えばスペクトラム表示画面上において周波数軸を10分割し、この分割中で、被測定信号101の中心周波数f_cを5／10の位置にくるように測定系の中心周波数を制御し、かつ2／10～8／10区間の位置に被測定信号101の帯域成分が収まるように掃引スパンを自動制御する。そしてこの区間のパワーを積分して電力を得る。この電力測定で得た結果から被測定信号の電力が得られ、上述第1段階による減衰レンジをもとに該減衰レンジの設定に連動して中間周波数の可変ゲインアンプのゲインを制御して測定系全体のゲイン

を所定の状態にすることで歪みを生じない減衰レンジに最適制御可能となる。この結果、周波数変換歪みが無く、S／Nが良く、測定精度の良い減衰レンジの自動制御が可能となる利点が得られる。

【００２０】上述適正化を実施の後、切替器８６を変調解析側に切替えて本来の変調解析を実施する。尚、この減衰量設定の適正化実施は、所望により変調解析測定の合間、あるいは減衰量設定の適正化の実行を起動するキー入力を受けた都度、あるいは随時実行するようにしても良い。

【００２１】上述発明の構成によれば、入力減衰器５０により減衰された未知電力減衰信号５１を直接測定して概略の減衰レンジを特定し、更にパワー測定アプリケーションを用いて被測定信号の電力を各々測定し、この結果をもとに測定系全体のゲインを所定の状態にするため、周波数変換部６０のミキサ入力端は適正な入力レベルに制御可能となるので、広帯域に分布した被測定周波数信号においても入力レベルの適正化が的確容易に実現できることとなる。従って、被測定信号が歪んで変調解析の誤差要因や電力測定の誤差要因を生じる難点が解消できる大きな利点が得られる。

【００２２】（実施例２）本発明実施例について図３の変調解析装置の構成図を示して説明する。尚、従来構成に対応する要素は同一符号を付す。本発明では周波数変換部６０は周波数を非掃引（ゼロスパンモード）としておき、中間周波数信号ＩＦ２の３次高調波成分まで信号処理可能な高速ＡＤ変換器９４を用いてデジタルデータに変換して第２の中間周波数信号ＩＦ２の基本波成分と３次高調波成分との差を検出測定することで、得られた前記基本波成分と３次高調波成分との差が増加に転ずる減衰レンジを特定し、これから入力減衰器５０を最適レンジに設定制御する手法である。

【００２３】構成は、図３に示すように従来構成要素に対して、変調解析部８０内にＬＰＦ９２と、高速ＡＤ変換器９４とを追加した構成で成る。

【００２４】実施例１と同様に、変調解析の測定に先立って、以下に説明する手段により入力減衰器５０の減衰量設定の適正化を行う。但し、予め被測定信号１０１の変調解析対象となる基本周波数は得ておく。先ず周波数変換部６０はゼロスパンモードとして周波数を非掃引にする。この状態で周波数変換部８２が出力する中間周波数信号ＩＦ２の基本波成分と３次高調波成分を測定する。例えば中間周波数信号ＩＦ２を２０ＭＨｚと仮定すると基本波成分は２０ＭＨｚで３次高調波成分は６０ＭＨｚである。この３次高調波成分を含んだ交流信号を高速ＡＤ変換器９４でデジタルデータに変換し、このデータをＦＦＴ処理して被測定信号１０１の基本波成分と３次高調波成分の差を求める。この基本波成分と３次高調波成分の差の測定処理を入力減衰器５０の減衰レンジを順次切替えて実施する。これらの測定結果を、図６（ｂ）の３次高調波レベルの推移例に示す。この推移図ではポイント３０１が増加に転じ始めていることが判る。この判定結果により、入力減衰器５０の最適設定すべき減衰レンジはポイント３００として容易に求まる。そしてこの減衰レンジの設定に連動して、実施例１と同様に中間周波数の可変ゲインアンプ７２のゲインを増減させて、測定系全体のゲインを当初の所定増幅度となるように設定制御することは言うまでもない。これにより周波数変換部６０のミキサ回路への入力は最適な入力レベルに設定制御される。

【００２５】上述発明の構成によれば、入力減衰器５０の減衰レンジを順次変えて、被測定信号１０１を周波数変換した中間周波数信号ＩＦ２の基本波成分と３次高調波成分の差を求め、この基本波成分と３次高調波の差レベルの推移が増加に転じる減衰レンジを特定することで、最適な減衰レンジが検出可能となる結果、被測定信号が歪んで変調解析の誤差要因や電力測定の誤差要因を生じる難点が解消できる大きな利点が得られる。

【００２６】尚、上述実施例１では、図１に示す変調解析装置の具体構成例により、入力減衰器５０の出力端の未知電力減衰信号５１のレベルを直接測定する構成例としていたが、所望により図２に示すように、高周波増幅器２０と検波部２５と切替器３０とによって未知電力減衰信号５１のレベルを直接測定する構成としても良く、同様にして実施可能である。

【００２７】尚、上述実施例２では、図３に示す変調解析装置の具体構成例により、３次高調波成分を測定する構成例としていたが、所望により図９に示すように、中間周波数信号における一次レベル信号のみを通過させるＢＰＦ（バンドパスフィルタ）を設けてフィルタし、これを検波してレベルを測定し、更に中間周波数信号における三次レベル信号のみを通過させるＢＰＦ（バンドパスフィルタ）を設けてフィルタし、これを検波してレベルを測定し、前記測定を減衰レンジを順次変えて一次レベル信号と三次レベル信号の両者を求め、これから一次と三次レベルとの差レベルが増加に転ずる減衰レンジが特定できるので、同様にして入力減衰器５０の減衰レンジを適正化制御する構成手段としても良い。

【００２８】尚、上述実施例１の説明では、変調解析装置に適用した具体例で説明していたが、図４に示すように、高周波増幅器２０と検波部２５と切替器３０を追加したスペクトラムアナライザの構成とし、同様に入力減衰器５０により減衰された未知電力減衰信号５１のレベルを直接測定して減衰レンジを最適化制御することで、同様にして入力レベルの最適化を実現可能であることは明白である。

【００２９】尚、上述実施例２においても、変調解析装置に適用した具体例で説明していたが、図８に示すように、従来のスペクトラムアナライザの構成においても、周波数変換部８２とＬＰＦ９２と高速ＡＤ変換器９４を

設けて、上述実施例２の手法である基本波成分と３次高調波成分との差を順次測定し、得た基本波成分と３次高調波成分との差から増加に転ずる減衰レンジを特定して、入力減衰器５０を適正化制御する手法を設けることにより実現可能である。

【００３０】尚、上述実施例１では、図１あるいは図３に示す変調解析装置の具体構成例で説明していたが、所望により図７に示すように、両方の制御手段を併用する構成としても良い。即ち、未知電力減衰信号５１を直接測定し、この測定結果に基づき入力減衰器５０と中間周波数の可変ゲインアンプ７２を適正に制御した後、更に基本波成分と３次高調波を測定して基本波成分と３次高調波との差が増加に転ずる推移を検出して、最適な入力減衰器５０の設定に制御する両手法を併用する構成である。

【００３１】

【発明の効果】本発明は、上述の説明内容から、下記に記載される効果を奏する。第１に、上述実施例１の発明構成によれば、入力減衰器５０により減衰された未知電力減衰信号５１を直接測定して概略の減衰レンジを特定し、更にパワー測定アプリケーションを用いて被測定信号の電力を各々測定し、この結果をもとに測定系全体のゲインを所定の状態にすることで周波数変換部６０のミキサ入力端を適正な入力レベルに制御可能となるので、広帯域に分布した被測定周波数信号においても入力レベルの適正化が的確容易に実現できることとなる。従って、被測定信号が歪んで変調解析の誤差要因や電力測定の誤差要因を生じる難点が解消できる大きな利点が得られる。また、スペクトラムアナライザの構成の場合も、同様にして入力レベルの適正化の利点が得られる。

【００３２】第２に、上述実施例２の発明構成によれば、入力減衰器５０の減衰レンジを順次変えて、被測定信号１０１を周波数変換した中間周波数信号ＩＦ２の基本波成分と３次高調波成分との差を求め、この基本波成分と３次高調波との差レベルの推移が増加に転じる減衰レンジを特定することで、最適な減衰レンジが検出可能となる結果、被測定信号が歪んで変調解析の誤差要因や電力測定の誤差要因を生じる難点が解消できる大きな利点が得られる。また、スペクトラムアナライザの構成の場合も、同様にして入力レベルの適正化の利点が得られる。

【図面の簡単な説明】

【図１】　本発明の、変調解析装置の構成例である。

【図２】　本発明の、変調解析装置の他の構成例である。

【図３】　本発明の、変調解析装置の他の構成例である。

【図４】　本発明の、スペクトラムアナライザの構成例である。

【図５】　従来の、変調解析装置の構成例である。

【図６】　広帯域に分布する周波数信号例と、基本波と３次高調波との差のレベルの推移例である。

【図７】　本発明の、変調解析装置の他の構成例である。

【図８】　本発明の、スペクトラムアナライザの他の構成例である。

【図９】　本発明の、変調解析装置の他の構成例である。

【図１０】　本発明の、周波数スペクトラムからのパワー測定例である。

【符号の説明】

２０　高周波増幅器
２５，７６　検波部
３０，８６　切替器
５０　入力減衰器
６０，８２　周波数変換部
７０　ＩＦフィルタ
７２，８４　可変ゲインアンプ
７４　対数変換部
７８，９０　ＡＤ変換器
８０　変調解析部
９４　高速ＡＤ変換器
１４０　表示装置
９８　信号処理部
１００　被試験装置
１２０　表示処理部

【手続補正２】

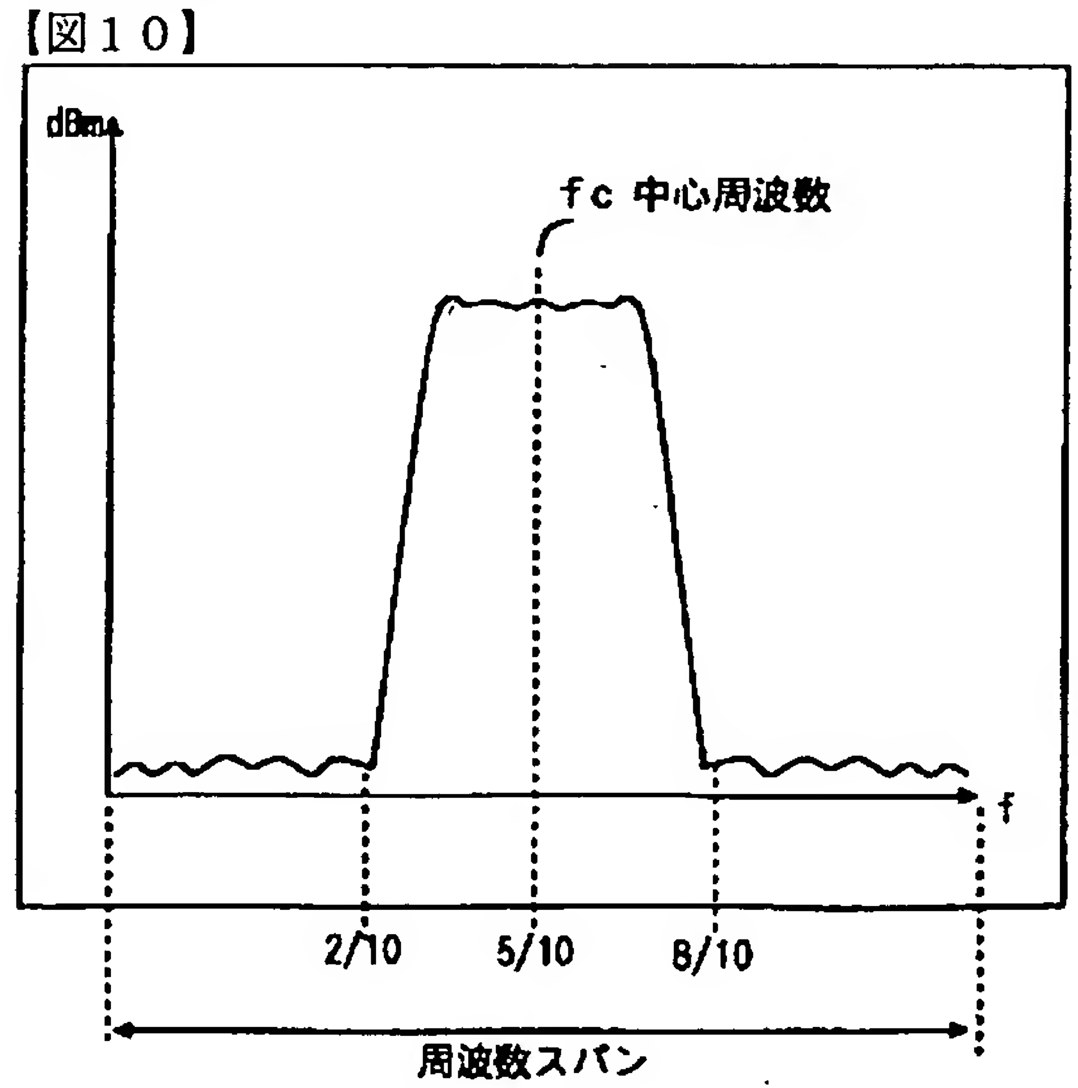
【補正対象書類名】図面

【補正対象項目名】図１０

【補正方法】変更

【補正内容】

【図１０】



CLAIMS

[Claim(s)]
[Claim 1] In response to the measurement signal-ed of strange power, frequency conversion is carried out to an intermediate frequency predetermined in the frequency-conversion section in response to the strange power attenuation signal which was made to decrease with an input attenuator and was decreased. In the modulation analysis equipment which carries out the filter of this by the IF filter, supplies the modulation analysis section, and performs modulation analysis A means to amplify and detect this signal in response to the strange power attenuation signal decreased with this input attenuator, and to detect the strange power level in the outgoing end of this input attenuator, Setting-out control of the attenuation range is carried out in the direction which increases the magnitude of attenuation of this input attenuator when the power level value acquired with this strange power detection means to the 1st is higher than a predetermined upper limit. In the attenuation range obtained by the means which carries out setting-out control of the attenuation range, and **** in the direction which decrease in number the magnitude of attenuation of this input attenuator when the power level value acquired with this strange power detection means to the 2nd is lower than a predetermined lower limit, and the attenuation range of order The means which carries out the frequency sweep of the section including the power measurement band of a measurement signal-ed in the frequency-conversion section, carries out measurement calculation of the power of a measurement signal-ed respectively, and carries out setting-out control at the attenuation range optimal based on this measurement power value, Modulation analysis equipment characterized by the means which is interlocked with setting out of this attenuation range, controls the gain of the adjustable gain amplifier of an intermediate frequency, and changes the gain control of the gain of the whole system of measurement into a predetermined condition, and providing the above.
[Claim 2] In response to the measurement signal-ed of strange power, frequency conversion is carried out to an intermediate frequency predetermined in the frequency-conversion section in response to the strange power attenuation signal which was made to decrease with an input attenuator and was decreased. In the spectrum analyzer which carries out the filter of this by the IF filter, and measures it A means to amplify and detect this signal in response to the strange power attenuation signal decreased with this input attenuator, and to detect the strange power level in the outgoing end of this input attenuator, ****** control of the attenuation range is carried out in the direction which increases the magnitude of attenuation of this input attenuator when the power level value acquired with this strange power detection means to the 1st is higher than a predetermined upper limit. In the attenuation range obtained by the means which carries out setting-out control of the attenuation range, and **** in the direction which decrease in number the magnitude of attenuation of this input attenuator when the power level value acquired with this strange power detection means to the 2nd is lower than a predetermined lower limit, and the attenuation range of order The means which carries out the frequency sweep of the section including the power measurement band of a measurement signal-ed in the frequency-conversion section, carries out measurement calculation of the power of a measurement signal-ed respectively, and carries out setting-out control at the attenuation range optimal based on this measurement power value, The means which is interlocked with setting out of this attenuation range, controls the gain of the adjustable gain amplifier of an intermediate frequency, and changes the gain control of the gain of the whole system of measurement into a predetermined condition, and the spectrum analyzer characterized by providing the above.
[Claim 3] In response to the measurement signal-ed of strange power, frequency conversion is carried out to an intermediate frequency predetermined in the frequency-conversion section in response to the strange power attenuation signal which was made to decrease with an input attenuator and was decreased. In the modulation analysis equipment which carries out the filter of this by the IF filter, supplies the modulation analysis section, and performs modulation analysis The frequency-conversion section makes a frequency a non-sweep, and the signal changed into the 2nd still lower intermediate frequency signal in the frequency-conversion section of modulation analysis circles is received. this — the high-speed A-D converter in which signal processing is

possible to the 3rd harmonic content of the 2nd intermediate frequency signal — using — digital data — changing — this — with a means to measure the 3rd harmonic content of the 2nd intermediate frequency signal A means to change the magnitude of attenuation of the attenuation range of this input attenuator one by one with the measurement means of said 3rd harmonic content, and to measure the 3rd harmonic content respectively, A means to specify the attenuation range which the 3rd harmonic content changes to an increment in response to the value for every attenuation range of the 3rd harmonic content obtained above, and to set the attenuation range of an input attenuator as the optimal range after this, Modulation analysis equipment characterized by the means which is interlocked with this optimal range setting out, controls the gain of the adjustable gain amplifier of an intermediate frequency, and changes the gain control of the gain of the whole system of measurement into a predetermined condition, and providing the above.

[Claim 4] In response to the measurement signal-ed of strange power, frequency conversion is carried out to an intermediate frequency predetermined in the frequency-conversion section in response to the strange power attenuation signal which was made to decrease with an input attenuator and was decreased. In the spectrum analyzer which carries out the filter of this by the IF filter, and measures it The frequency-conversion section makes a frequency a non-sweep, and the signal changed into the 2nd still lower intermediate frequency signal in the frequency-conversion section of modulation analysis circles is received. this — the high-speed A-D converter in which signal processing is possible to the 3rd harmonic content of the 2nd intermediate frequency signal — using — digital data — changing — this — with a means to measure the 3rd harmonic content of the 2nd intermediate frequency signal A means to change the magnitude of attenuation of the attenuation range of this input attenuator one by one with the measurement means of said 3rd harmonic content, and to measure the 3rd harmonic content respectively, A means to specify the attenuation range which the 3rd harmonic content changes to an increment in response to the value for every attenuation range of the 3rd harmonic content obtained above, and to set the attenuation range of an input attenuator as the optimal range after this, The means which is interlocked with this optimal range setting out, controls the gain of the adjustable gain amplifier of an intermediate frequency, and changes the gain control of the gain of the whole system of measurement into a predetermined condition, and the spectrum analyzer characterized by providing the above.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to optimization of the input level of a test-frequency-ed signal. It is related with optimization of the input level of a test-frequency-ed signal distributed over the broadband by which especially spectrum diffusion was carried out.
[0002]
[Description of the Prior Art] The block diagram of the modulation analysis equipment of drawing 5 is shown and explained about the conventional technical example. This modulation analysis equipment is the example of a configuration which made the spectrum analyzer the basic configuration and added the analysis feature in connection with the various modulations of a measurement signal-ed in response to this intermediate frequency signal (IF signal).
[0003] A configuration changes with the testing device 100-ed, the input attenuator 50, the frequency-conversion section 60, IF filter 70, the adjustable gain amplifier 72, the logarithmic transformation section 74, the detection section 76, A-D converter 78, the modulation analysis section 80, the display-processing section 120, and a display 140. In addition, since the configuration of a spectrum analyzer is known well technically, it omits explanation.
[0004] The internal configuration of the modulation analysis section 80 changes in the frequency-conversion section 82, the adjustable gain amplifier 84, A-D converter 90, and the signal-processing section 98. This modulation analysis section is changed into the several MHz low intermediate frequency signal IF 2 by the frequency-conversion section 82, and carries out the measurement and data processing which carry out a high-speed sampling, carry out signal processing of the intermediate frequency signal amplified on the optimal level of A-D converter 90 with the adjustable gain amplifier 84 by A-D converter 90, and start various kinds of analyses and modulation precision, such as the modulation characteristic. The processed result displays a request with a display 140 through the display-processing section 120.
[0005] By the way, on the occasion of modulation measurement, a user needs to define the display level on the tubular surface of an indicating equipment 140. The order of a way which sets up this tubular surface level is explained. The measurement signal 101-ed which the testing device 100-ed outputs here assumes that it is the case of the signalling frequency which is distributed over broadbands, such as CDMA (Code Division Multiple Access), and by which spectrum diffusion was carried out like the signalling frequency 201 shown in drawing 6 (a). It sets up near center frequency fc first shown in drawing 6 (a), and the input level is indicated by the tubular surface in zero frequency span mode (mode which does not carry out the sweep of the frequency). And by key input setting out, it is set as the desired input sensitivity and the reference level to which spectrum level becomes legible greatly. Automatic setting of the input attenuator 50 and the adjustable gain amplifier 72 for IF signals is carried out to the predetermined magnitude of attenuation and the predetermined amount of magnification as a result of this setting out. In addition, the input attenuator 50 is an attenuator of for example, 10dB step, and the adjustable gain amplifier 72 is adjustable amplifier for example, with a fine 0.1 dB/Div. step.
[0006]
[Problem(s) to be Solved by the Invention] By the way, as shown in drawing 6 (a), the level in each frequency point is low because of the signalling frequency 201 distributed to the broadband. For this reason, setting out of the input attenuator 50 is the small magnitude of attenuation with setting out of the above-mentioned tubular surface display level. However, the total power of the perimeter wave number diffused in the broadband is large level. Consequently, the strange power attenuation signal 51 decreased with the input attenuator 50 shown in drawing 5 is comparatively big level. This signal is supplied to the input edge of the mixer circuit of the frequency-conversion section 60. Consequently, a mixer circuit may serve as an excessive input level. In the

case of an excessive input level, a test-frequency-ed signal is distorted, the Nth higher harmonic is produced or nonconformity, like the linearity of frequency-conversion gain changes a lot is produced. These nonconformities have a practical difficulty preferably as a measuring device in order to puff up the modulation analysis of a testing device-ed, and the error of power measurement. In addition, it cannot be overemphasized in the signalling frequency of the strange power which also set to the general spectrum analyzer which does not have the modulation analysis section 80 shown in drawing 5 , and was distributed or dispersed to the broadband etc. that there is same difficulty.

[0007] Then, the technical problem which this invention tends to solve is offering the modulation analysis equipment and the spectrum analyzer which made optimization of an input level realizable also in the test-frequency-ed signal distributed or dispersed to the broadband.

[0008]

[Means for Solving the Problem] Figs. 1 or 2 and drawing 10 show the solution means concerning the modulation analysis equipment of this invention. In order to solve the above-mentioned technical problem to the 1st, with the configuration of this invention It is made to decrease with the input attenuator 50 in response to the measurement signal 101-ed of strange power. In the modulation analysis equipment which carries out frequency conversion to the intermediate frequency IF 1 predetermined in the frequency-conversion section 60 in response to the decreased strange power attenuation signal 51, carries out the filter of this by IF filter 70, supplies the modulation analysis section 80, and performs modulation analysis A means to amplify and-detect this signal in response to the strange power attenuation signal 51 decreased with the input attenuator 50, and to detect the strange power level in the outgoing end of the input attenuator 50 is provided. Setting-out control of the attenuation range is carried out in the direction which increases the magnitude of attenuation of the input attenuator 50 when the power level value acquired with the above-mentioned strange power detection means to the 1st is higher than a predetermined upper limit. The means of the coarse control which carries out setting-out control of the attenuation range is provided in the direction which decrease in number the magnitude of attenuation of the input attenuator 50 when the power level value acquired with the above-mentioned strange power detection means to the 2nd is lower than a predetermined lower limit. In the attenuation range obtained by ****, and the attenuation range of order, carry out the frequency sweep of the section including the power measurement band of the measurement signal 101-ed in the frequency-conversion section 60, and measurement calculation of the power of the measurement signal 101-ed is carried out respectively. It is a configuration means to provide the means of the optimum coordination which carries out setting-out control in the optimal attenuation range from this measurement power value, and to provide the means which is interlocked with setting out of the above-mentioned attenuation range, controls the gain of the adjustable gain amplifier 72 of an intermediate frequency, and changes the gain control of the gain of the whole system of measurement into a predetermined condition. The modulation analysis equipment which made optimization of an input level realizable also to the test-frequency-ed signal distributed over the broadband with the means of the above-mentioned coarse control and optimum coordination is realizable.

[0009] Drawing 4 shows the solution means concerning the spectrum analyzer of this invention. In order to solve the above-mentioned technical problem to the 2nd, with the configuration of this invention It is made to decrease with the input attenuator 50 in response to the measurement signal 101-ed of strange power. In the spectrum analyzer which carries out frequency conversion to the intermediate frequency IF 1 predetermined in the frequency-conversion section 60 in response to the decreased strange power attenuation signal 51, carries out the filter of this by IF filter 70, and is measured A means to amplify and detect this signal in response to the strange power attenuation signal 51 decreased with the input attenuator 50, and to detect the strange power level in the outgoing end of the input attenuator 50 is provided. Setting-out control of the attenuation range is carried out in the direction which increases the magnitude of attenuation of the input attenuator 50 when the power level value acquired with the above-mentioned strange power detection means to the 1st is higher than a predetermined upper limit. The means of the coarse control which carries out setting-out control of the attenuation range is provided in the direction which decrease in number the magnitude of attenuation of the input attenuator 50 when the power level value acquired with the above-mentioned strange power detection means to the 2nd is lower than a predetermined lower limit. In the attenuation range obtained by ****, and the attenuation range of order, carry out the frequency sweep of the section including the power measurement band of the measurement signal 101-ed in the frequency-conversion section 60, and measurement calculation of the power of the measurement signal 101-ed is carried out respectively. The means of the optimum coordination which carries out setting-out control is provided in the optimal attenuation range from this measurement power value, setting out of the above-mentioned attenuation range is interlocked with, the gain of the adjustable gain amplifier 72 of an intermediate frequency is controlled, and there is a configuration means to provide the means

which changes the gain control of the gain of the whole system of measurement into a predetermined condition. The spectrum analyzer which made optimization of an input level realizable also to the test-frequency-ed signal distributed over the broadband with the means of the above-mentioned coarse control and optimum coordination is realizable.

[0010] Drawing 3 and drawing 6 (b) show the solution means concerning the modulation analysis equipment of this invention. In order to solve the above-mentioned technical problem to the 3rd, with the configuration of this invention It is made to decrease with the input attenuator 50 in response to the measurement signal 101-ed of strange power. In the modulation analysis equipment which carries out frequency conversion to the intermediate frequency IF 1 predetermined in the frequency-conversion section 60 in response to the decreased strange power attenuation signal 51, carries out the filter of this by IF filter 70, supplies the modulation analysis section 80, and performs modulation analysis The frequency-conversion section 60 makes a frequency a non-sweep (zero frequency span mode), and the signal changed into the 2nd still lower intermediate frequency signal IF 2 in the frequency-conversion section 82 in the modulation analysis section 80 is received. A means to change into digital data using high-speed A-D converter 94 in which signal processing is possible to the 3rd harmonic content of the 2nd intermediate frequency signal IF 2, and to measure the 3rd harmonic content of the 2nd intermediate frequency signal IF 2 is provided. A means to change the magnitude of attenuation of the attenuation range of the above-mentioned input attenuator 50 one by one with the measurement means of said 3rd harmonic content, and to measure the 3rd harmonic content respectively is provided. In response to the value for every attenuation range of the 3rd harmonic content obtained above, the attenuation range which the 3rd harmonic content changes to an increment is specified. A means to, set the attenuation range of the input attenuator 50 as the optimal range from now on is provided, the above-mentioned optimal range setting out is interlocked with, the gain of the adjustable gain amplifier 72 of an intermediate frequency is controlled, and there is a configuration means to provide the means which changes the gain control of the gain of the whole system of measurement into a predetermined condition. The modulation analysis equipment which made optimization of an input level realizable also in the test-frequency-ed signal distributed over the broadband by the above-mentioned technique as a result of transition which the 3rd higher harmonic of the 2nd intermediate frequency signal IF 2 changes to an increment becoming detectable is realizable.

[0011] Drawing 8 shows the solution means concerning the spectrum analyzer of this invention. In order to solve the above-mentioned technical problem to the 4th, with the configuration of this invention It is made to decrease with the input attenuator 50 in response to the measurement signal 101-ed of strange power. In the spectrum analyzer which carries out frequency conversion to the intermediate frequency IF 1 predetermined in the frequency-conversion section 60 in response to the decreased strange power attenuation signal 51, carries out the filter of this by IF filter 70, and is measured The frequency-conversion section 60 makes a frequency a non-sweep (zero frequency span mode), and the signal changed into the 2nd still lower intermediate frequency signal IF 2 in the frequency-conversion section 82 in the modulation analysis section 80 is received. A means to change into digital data using high-speed A-D converter 94 in which signal processing is possible to the 3rd harmonic content of the 2nd intermediate frequency signal IF 2, and to measure the 3rd harmonic content of the 2nd intermediate frequency signal IF 2 is provided. A means to change the magnitude of attenuation of the attenuation range of the input attenuator 50 one by one with the measurement means of said 3rd harmonic content, and to measure the 3rd harmonic content respectively is provided. In response to the value for every attenuation range of the 3rd harmonic content obtained above, the attenuation range which the 3rd harmonic content changes to an increment is specified. A means to, set the attenuation range of the input attenuator 50 as the optimal range from now on is provided, the above-mentioned optimal range setting out is interlocked with, the gain of the adjustable gain amplifier 72 of an intermediate frequency is controlled, and there is a configuration means to provide the means which changes the gain control of the gain of the whole system of measurement into a predetermined condition. The spectrum analyzer which made optimization of an input level realizable also in the test-frequency-ed signal distributed over the broadband by the above-mentioned technique as a result of transition which the 3rd higher harmonic of the 2nd intermediate frequency signal IF 2 changes to an increment becoming detectable is realizable.

[0012]

[Embodiment of the Invention] The gestalt of operation of this invention is explained with reference to a drawing with an example below at a detail.

[0013] (Example 1) The block diagram of the modulation analysis equipment of drawing 1 is shown and explained about this invention example. In addition, the element corresponding to a configuration attaches the same sign conventionally. In this invention, by the 1st step, the strange power attenuation signal 51 decreased with the input attenuator 50 is measured directly, the coarse control of the attenuation range is carried out, the swept

frequency generation of the frequency section including the power measurement band of the measurement signal 101-ed is carried out in the frequency-conversion section 60, power is measured and setting-out control of the input attenuator 50 is eventually carried out in the 2nd step at the optimal range based on this.
[0014] A configuration changes to a component with the configuration of having added the high-frequency amplifier 20, the detection section 25, and a switcher 86, conventionally, as shown in drawing 1 . In advance of measurement of the modulation analysis in the coarse control of the 1st step, magnitude-of-attenuation setting out of the input attenuator 50 is rationalized with a means to explain below. At this time, the switcher 86 is changed to the detection section 25 side.
[0015] The high-frequency amplifier 20 is amplified and outputted to a predetermined scale factor in response to the strange power attenuation signal 51 after decreasing with the input attenuator 50 and passing LPF (low pass filter). In response, the detection section 25 is detected and supplies detected direct-current-voltage signal 26dc to A-D converter 90 through a switcher 86. And the strange power data Dx which carried out digital conversion by A-D converter 90 are supplied to the signal-processing section 98.
[0016] In response to said strange power data Dx, it judges whether it is an excessive input state as compared with the upper limit level data Dlmt decided beforehand, and by this judgment result, the attenuation range of the input attenuator 50 is changed to a proper value, and is controlled by the signal-processing section 98. In addition, although the above-mentioned upper limit level data Dlmt use as the upper limit level data Dlmt maximum-input-voltage level which gave tolerance in consideration of dispersion in the mixer circuit of the frequency conversion section 60, they may ask for the allowance input level of a mixer circuit respectively for each device of every by request, and may use this as upper limit level data Dlmt.
[0017] In rationalization control of the above-mentioned attenuation range , change an attenuation range in the direction which increase the magnitude of attenuation of the input attenuator 50 since it be an excessive input level when the value of the strange power data Dx measured by the 1st be larger than the upper limit level data Dlmt , control , and this change be interlock with , and make the gain of the adjustable gain amplifier 72 of an intermediate frequency increase , and the setting-out control of the gain of the whole system of measurement carry out so that it may become the original predetermined amplification degree . More than the predetermined level (for example, 10dB) from the upper limit level data Dlmt, to the 2nd, the value of the strange power data Dx changes and controls an attenuation range in the direction which in the case of a low value decrease in number the magnitude of attenuation of the input attenuator 50 since it is a very small input level, is interlocked with this change, decreases the gain of the adjustable gain amplifier 72 of an intermediate frequency, and it carries out setting out control of the gain of the whole system of measurement so that it may become the original predetermined amplification degree. Thereby, the strange power attenuation signal 51 is rationalized.
[0018] With the means of only the above-mentioned detection section 25, it may not necessarily be proper. For this reason, the 2nd-step optimum coordination is performed using the power measurement function of a measuring device. This 2nd-step optimum coordination measures the power value of the signal made into the measuring object, and carries out optimum coordination. That is, the swept frequency generation of the frequency section including the power measurement band of the measurement signal 101-ed is carried out in the frequency-conversion section 60, power is measured, this power measurement is fluctuated from the established state of an attenuation range which obtained the attenuation range of the input attenuator 50 by the coarse control of the 1st step of above-mentioned, and adjustment control of the attenuation range is carried out at the optimal range.
[0019] As shown in the example of power measurement from the frequency spectrum of drawing 10 , specifically, power is computed by integrating with the power of this section using general power measurement application. For example, a frequency shaft is divided into 11 on the spectrum display screen, it is [this] under division, and the center frequency of system of measurement is controlled to come the center frequency fc of the measurement signal 101-ed to 6/11 of locations, and a sweep span is automatically controlled so that the band component of the measurement signal 101-ed may be settled in the location of the 8/[4/11 -] 11 section. And it integrates with the power of this section and power is obtained. The power of a measurement signal-ed is obtained from the result obtained by this power measurement, and optimal control in the attenuation range which does not produce distortion by setting out of this attenuation range being interlocked with based on an attenuation range by the 1st step of ****, controlling the gain of the adjustable gain amplifier of an intermediate frequency, and changing the gain of the whole system of measurement into a predetermined condition is attained. Consequently, there is no frequency translation distortion, S/N is good and the advantage whose automatic control of the good attenuation range of the accuracy of measurement becomes possible is acquired.
[0020] After carrying out the above-mentioned rationalization, a switcher 86 is changed to a modulation analysis side, and original modulation analysis is carried out. In addition, rationalization implementation of this magnitude-

of-attenuation setting out may be made to perform the key input which starts the interval of modulation analysis measurement, or activation of rationalization of magnitude-of-attenuation setting out by request carrier beam each time or at any time.
[0021] According to the configuration of the above-mentioned invention, measure directly the strange power attenuation signal 51 decreased with the input attenuator 50, and the attenuation range of an outline is specified. Furthermore, since the mixer input edge of the frequency conversion section 60 becomes controllable at a proper input level in order to measure the power of a measurement signal-ed respectively using power measurement application and to change the gain of the whole system of measurement into a predetermined condition based on this result Also in the test-frequency-ed signal distributed over the broadband, rationalization of an input level can be realized exactly easily. Therefore, the big advantage which can cancel the difficulty which a measurement signal-ed is distorted and produces the error factor of modulation analysis and the error factor of power measurement is acquired.
[0022] (Example 2) The block diagram of the modulation analysis equipment of drawing 3 is shown and explained about this invention example. In addition, the element corresponding to a configuration attaches the same sign conventionally. It is the technique of being the frequency-conversion section's 60 making the frequency the non-sweep (zero frequency span mode), changing into digital data using high-speed A-D converter 94 in which signal processing's is possible to the 3rd harmonic content of the intermediate-frequency signal IF 2, and carrying out detection measurement of the 3rd harmonic content of the 2nd intermediate-frequency signal IF 2, specifying the attenuation range which said 3rd obtained harmonic content changes to an increment, and carrying out setting-out control of the input attenuator 50 by this invention, after this at the optimal range.
[0023] A configuration changes to a component with the configuration of having added LPF92 and high-speed A-D converter 94 in the modulation analysis section 80, conventionally, as shown in drawing 3 .
[0024] In advance of measurement of modulation analysis, magnitude-of-attenuation setting out of the input attenuator 50 is rationalized with a means to explain below, like an example 1. However, the fundamental frequency beforehand set as the modulation analysis object of the measurement signal 101-ed is obtained. The frequency-conversion section 60 makes a frequency a non-sweep as zero frequency span mode first. The fundamental-wave component and the 3rd harmonic content of the intermediate frequency signal IF 2 which the frequency-conversion section 82 outputs in this condition are measured. For example, when the intermediate frequency signal IF 2 is assumed to be 20MHz, the 3rd harmonic content of a fundamental-wave component is 60MHz in 20MHz. The AC signal containing this 3rd harmonic content is changed into digital data by high-speed A-D converter 94, FFT processing of this data is carried out, and the difference of the fundamental-wave component of the measurement signal 101-ed and the 3rd harmonic content is searched for. The attenuation range of the input attenuator 50 is changed one by one, and measurement processing of the difference of this fundamental-wave component and the 3rd harmonic content is carried out. These measurement results are shown in the example of transition of the 3rd higher-harmonic-wave level of drawing 6 (b). This transition drawing shows that the point 301 is beginning to start to increase. By this judgment result, the attenuation range which should carry out optimal setting out of the input attenuator 50 can be easily found as the point 300. And it cannot be overemphasized that setting out of this attenuation range is interlocked with, the gain of the adjustable gain amplifier 72 of an intermediate frequency as well as an example 1 is made to fluctuate, and setting-out control of the gain of the whole system of measurement is carried out so that it may become the original predetermined amplification degree. Thereby, setting-out control of the input to the mixer circuit of the frequency conversion section 60 is carried out at the optimal input level.
[0025] According to the configuration of the above-mentioned invention, the attenuation range of the input attenuator 50 is changed one by one. By specifying the attenuation range which searches for the difference of the fundamental-wave component of the intermediate frequency signal IF 2, and the 3rd harmonic content which carried out frequency conversion of the measurement signal 101-ed, and transition of the difference level of this fundamental-wave component and the 3rd higher harmonic wave changes to an increment As a result of the optimal attenuation range's becoming detectable, the big advantage which can cancel the difficulty which a measurement signal-ed is distorted and produces the error factor of modulation analysis and the error factor of power measurement is acquired.
[0026] In addition, by request, although considered as the example of a configuration which measures directly the level of the strange power attenuation signal 51 of the outgoing end of the input attenuator 50 in the above-mentioned example 1 by the example of a concrete configuration of the modulation analysis equipment shown in drawing 1 , as shown in drawing 2 , it is good also as a configuration which measures directly the level of the strange power attenuation signal 51 by the high-frequency amplifier 20, the detection section 25, and the switcher 30, and can carry out similarly.

[0027] In addition, although considered as the example of a configuration which measures the 3rd harmonic content in the above-mentioned example 2 by the example of a concrete configuration of the modulation analysis equipment shown in drawing 3 As a request shows to drawing 9 , the filter of the BPF (band pass filter) which passes only the primary level signal in an intermediate frequency signal is prepared and carried out. Detect this, measure level, and the filter of the BPF (band pass filter) which passes only the Miyoshi level signal in an intermediate frequency signal further is prepared and carried out. Since the attenuation range which detects this, measures level, changes an attenuation range for said measurement one by one, and asks for both primary level signal and Miyoshi level signal, and the difference level of primary and the Miyoshi level changes to an increment after this can be specified It is good also as a configuration means which carries out rationalization control of the attenuation range of the input attenuator 50 similarly.
[0028] In addition, although the example applied to modulation-analysis equipment explained in explanation of the above-mentioned example 1, as shown in drawing 4 , it is clear that optimization of an input level can be similarly realized by considering as the configuration of the spectrum analyzer which added the high-frequency amplifier 20, the detection section 25, and a switcher 30, measuring directly the level of the strange power attenuation signal 51 similarly decreased with the input attenuator 50, and carrying out the optimum control of the attenuation range.
[0029] In addition, although the example applied to modulation analysis equipment explained also in the above-mentioned example 2 As shown in drawing 8 , it also sets in the configuration of the conventional spectrum analyzer. Form the frequency-conversion section 82, LPF92, and high-speed A-D converter 94, and the attenuation range which carries out sequential measurement and changes the difference of the fundamental-wave component and the 3rd harmonic content which are the technique of the above-mentioned example 2 to an increment from the difference of the fundamental-wave component and the 3rd harmonic content which were obtained is specified. It is realizable by establishing the technique of carrying out rationalization control of the input attenuator 50.
[0030] In addition, although the example of a concrete configuration of the modulation analysis equipment shown in drawing 1 or drawing 3 explained in the above-mentioned example 1, it is good also as a configuration which uses both control means together by request as shown in drawing 7 . That is, after measuring directly the strange power attenuation signal 51 and controlling the input attenuator 50 and the adjustable gain amplifier 72 of an intermediate frequency proper based on this measurement result, it is the configuration which uses together the both-hands method which detects transition which measures a fundamental-wave component and the 3rd higher harmonic further, and the difference of a fundamental-wave component and the 3rd higher harmonic changes to an increment, and is controlled to setting out of the optimal input attenuator 50.
[0031]
[Effect of the Invention] This invention does so the effectiveness indicated by the following from the above-mentioned content of explanation. According to the invention configuration of the above-mentioned example 1, measure directly the strange power attenuation signal 51 decreased with the input attenuator 50 to the 1st, and the attenuation range of an outline is specified as it. Furthermore, by measuring the power of a measurement signal-ed respectively using power measurement application, and changing the gain of the whole system of measurement into a predetermined condition based on this result, since it becomes controllable at a proper input level, the mixer input edge of the frequency conversion section 60 Also in the test-frequency-ed signal distributed over the broadband, rationalization of an input level can be realized exactly easily. Therefore, the big advantage which can cancel the difficulty which a measurement signal-ed is distorted and produces the error factor of modulation analysis and the error factor of power measurement is acquired. Moreover, in the configuration of a spectrum analyzer, the advantage of rationalization of an input level is acquired similarly.
[0032] According to the invention configuration of the above-mentioned example 2, the attenuation range of the input attenuator 50 is changed into the 2nd one by one. By specifying the attenuation range which searches for the difference of the fundamental-wave component of the intermediate frequency signal IF 2 and the 3rd harmonic content which carried out frequency conversion of the measurement signal 101-ed, and transition of the difference level of this fundamental-wave component and the 3rd higher harmonic wave changes to an increment As a result of the optimal attenuation range's becoming detectable, the big advantage which can cancel the difficulty which a measurement signal-ed is distorted and produces the error factor of modulation analysis and the error factor of power measurement is acquired. Moreover, in the configuration of a spectrum analyzer, the advantage of rationalization of an input level is acquired similarly.

[Translation done.]

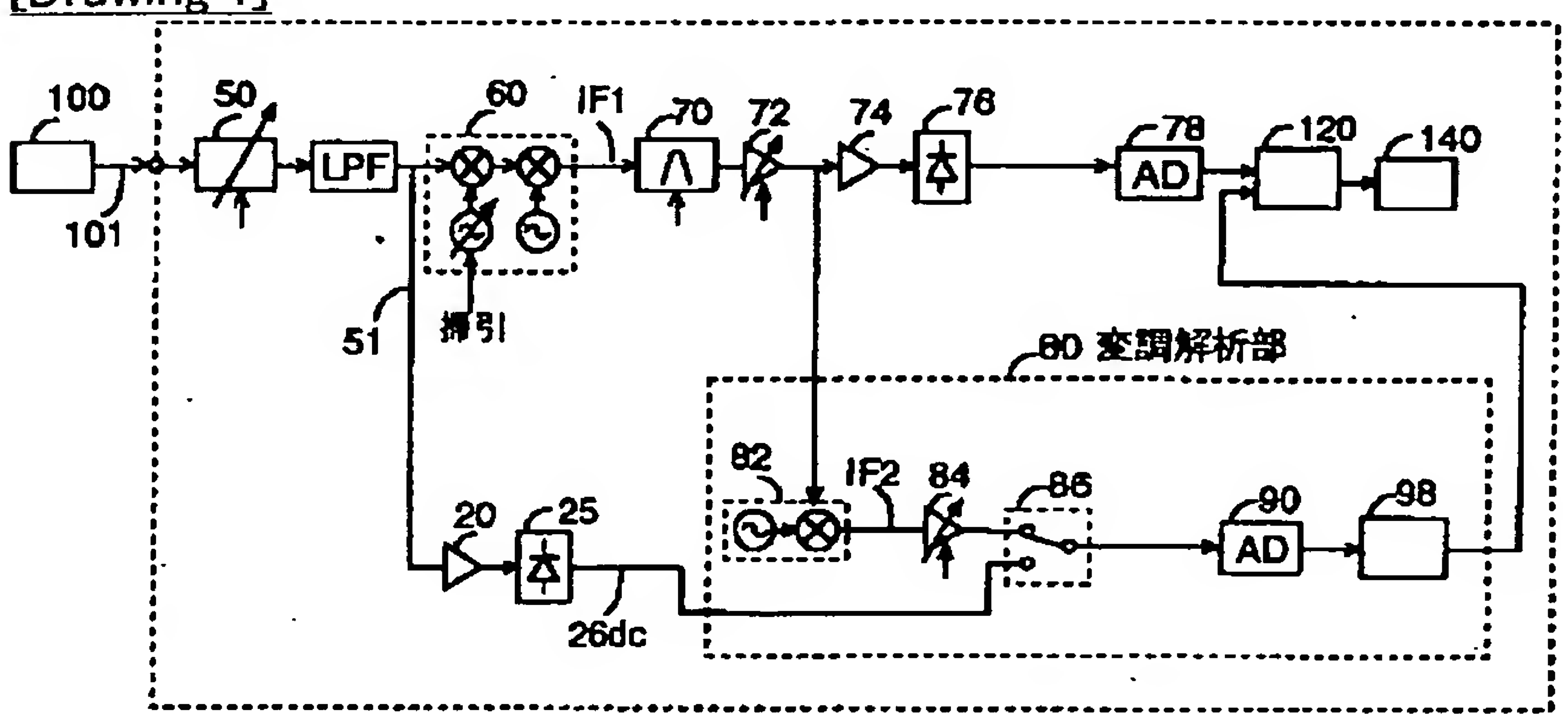
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the example of a configuration of modulation analysis equipment of this invention.
[Drawing 2] They are other examples of a configuration of modulation analysis equipment of this invention.
[Drawing 3] They are other examples of a configuration of modulation analysis equipment of this invention.
[Drawing 4] It is the example of a configuration of a spectrum analyzer of this invention.
[Drawing 5] It is the conventional example of a configuration of modulation analysis equipment.
[Drawing 6] They are the example of signalling frequency distributed over a broadband, and the example of transition of the level of the difference of a fundamental wave and the 3rd higher harmonic wave.
[Drawing 7] They are other examples of a configuration of modulation analysis equipment of this invention.
[Drawing 8] They are other examples of a configuration of a spectrum analyzer of this invention.
[Drawing 9] They are other examples of a configuration of modulation analysis equipment of this invention.
[Drawing 10] It is the example of power measurement from frequency spectrum of this invention.
[Description of Notations]
20 High-frequency Amplifier
25 76 Detection section
30 86 Switcher
50 Input Attenuator
60 82 Frequency-conversion section
70 IF Filter
72 84 Adjustable gain amplifier
74 Logarithmic Transformation Section
78 90 A-D converter
80 Modulation Analysis Section
94 High-speed A-D Converter
140 Display
98 Signal-Processing Section
100 Testing Device-ed
120 Display-Processing Section

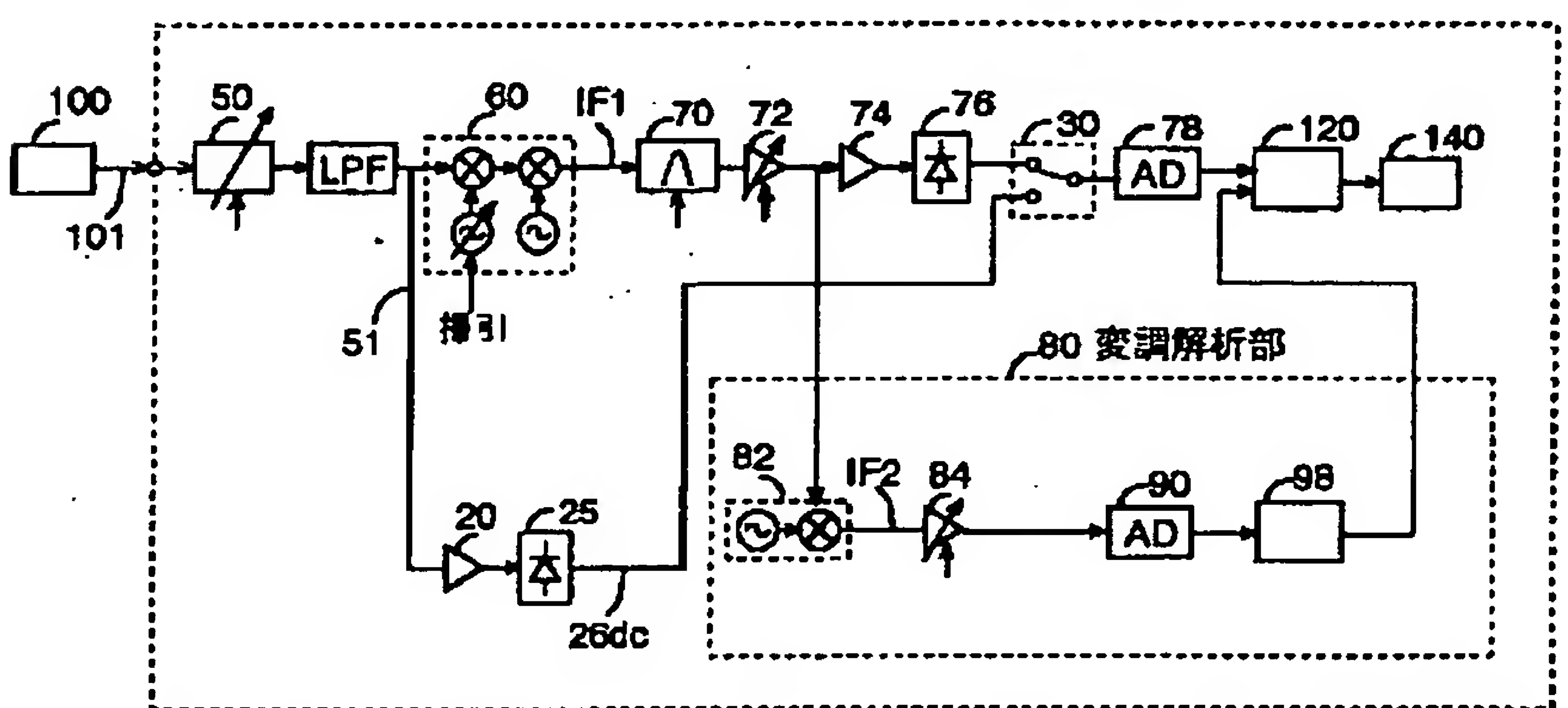
[Translation done.]

DRAWINGS

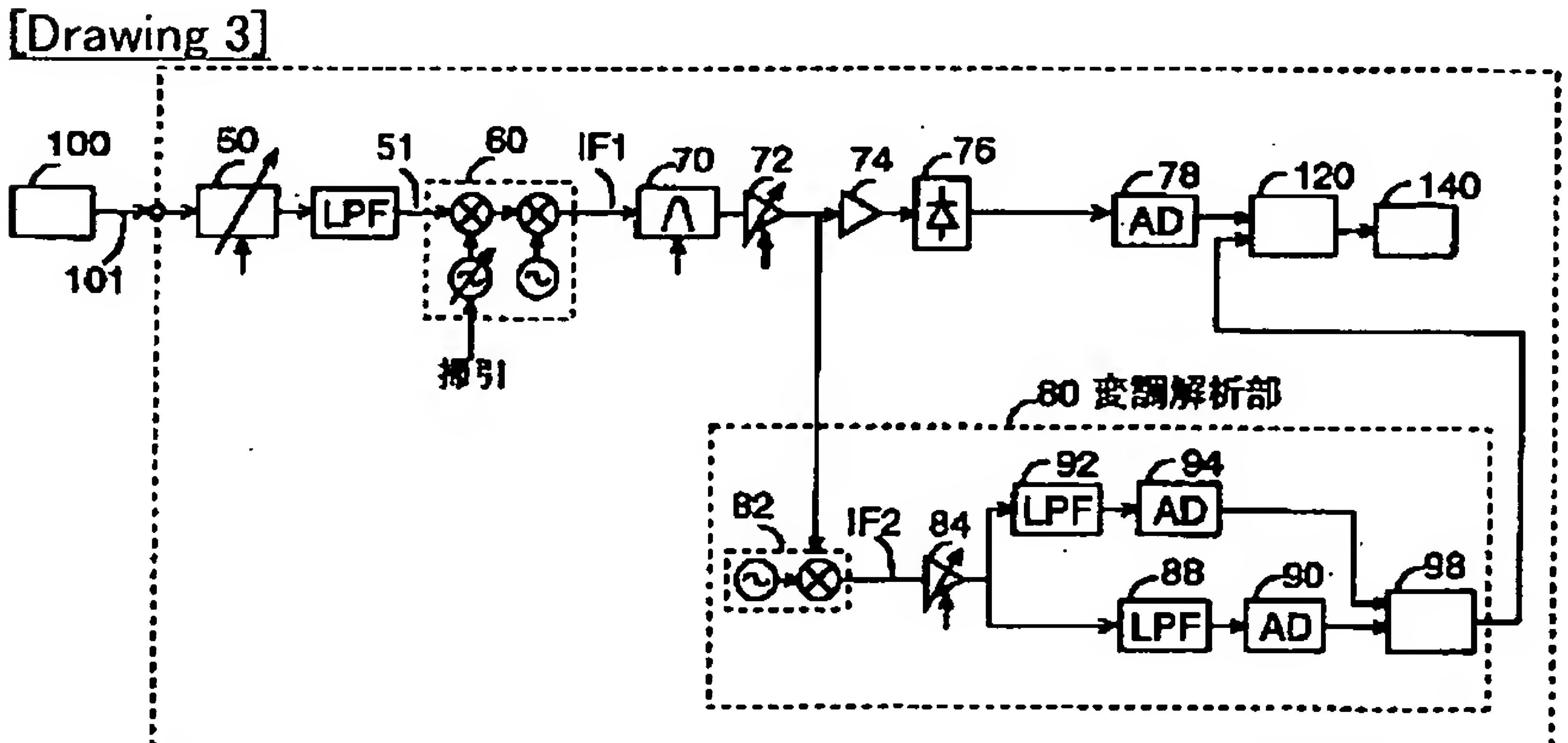
[Drawing 1]



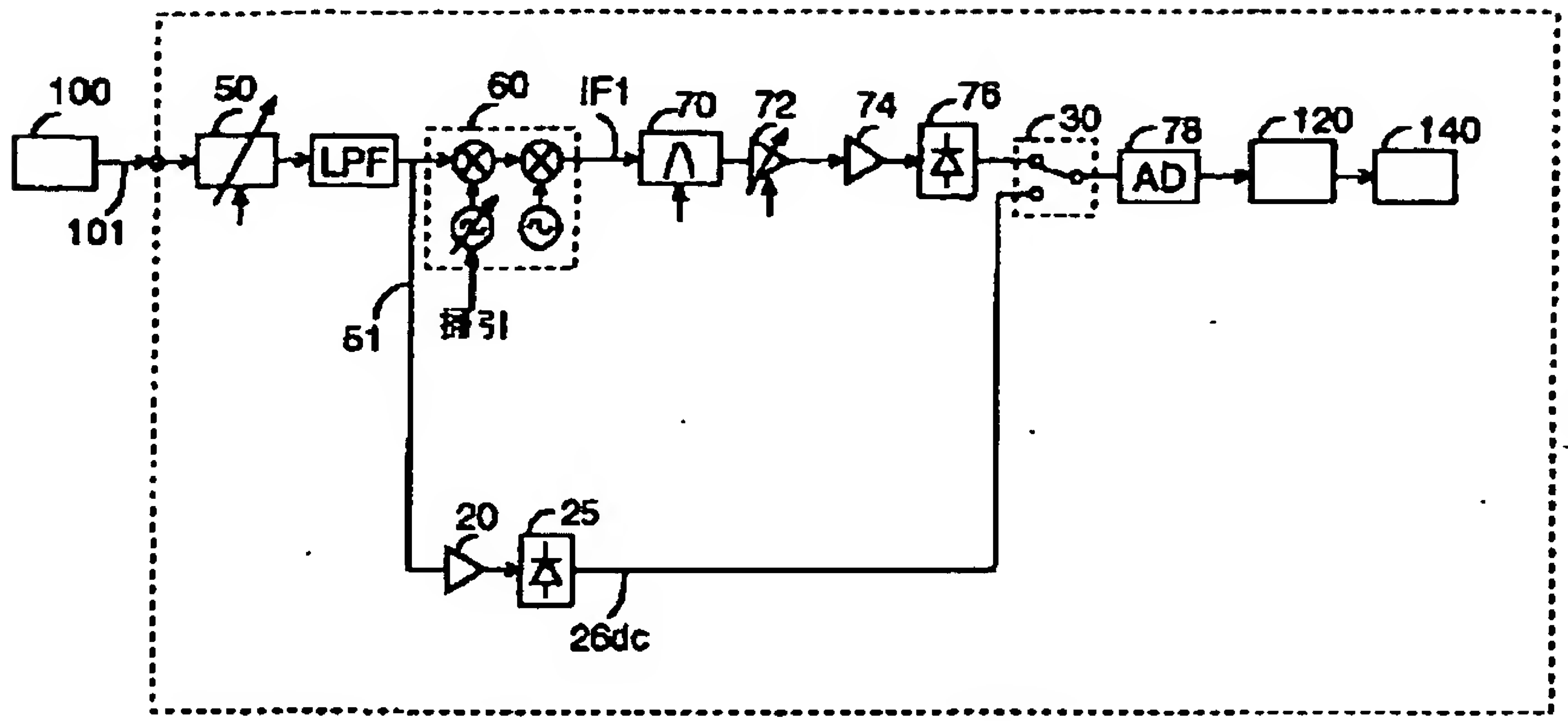
[Drawing 2]



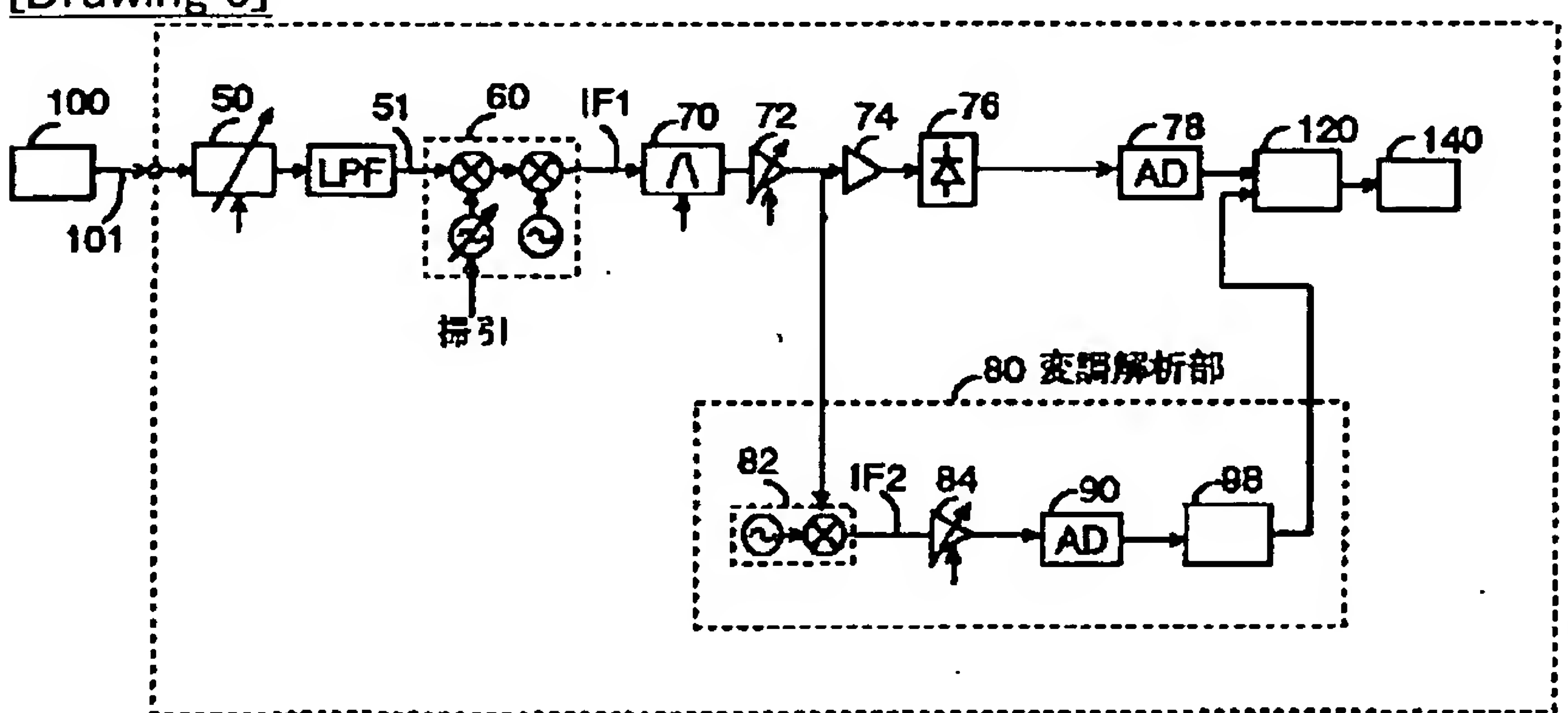
[Drawing 3]



[Drawing 4]

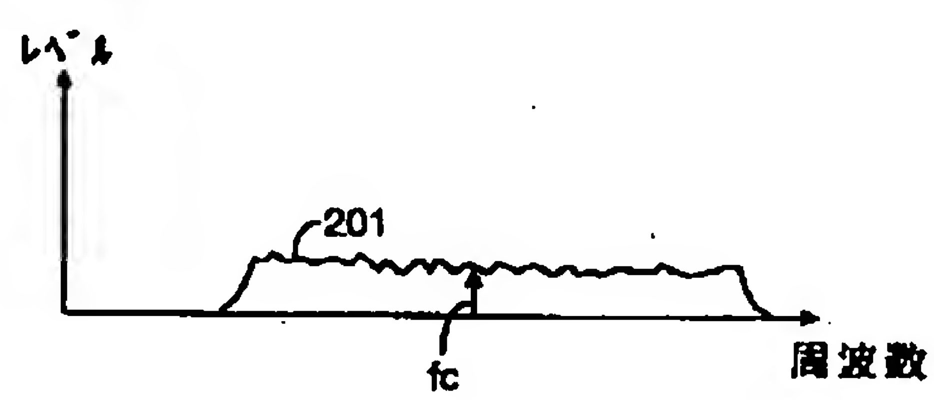


[Drawing 5]

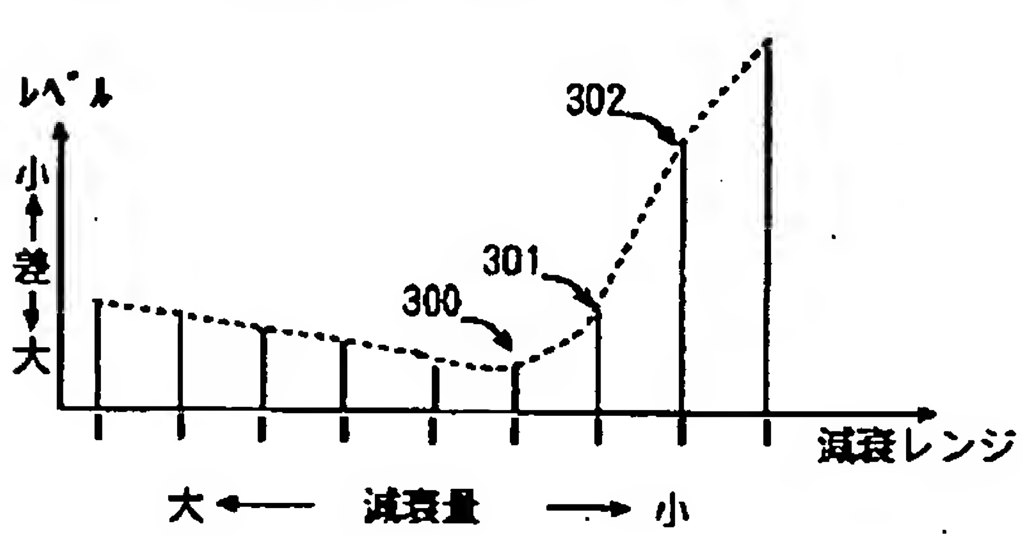


[Drawing 6]

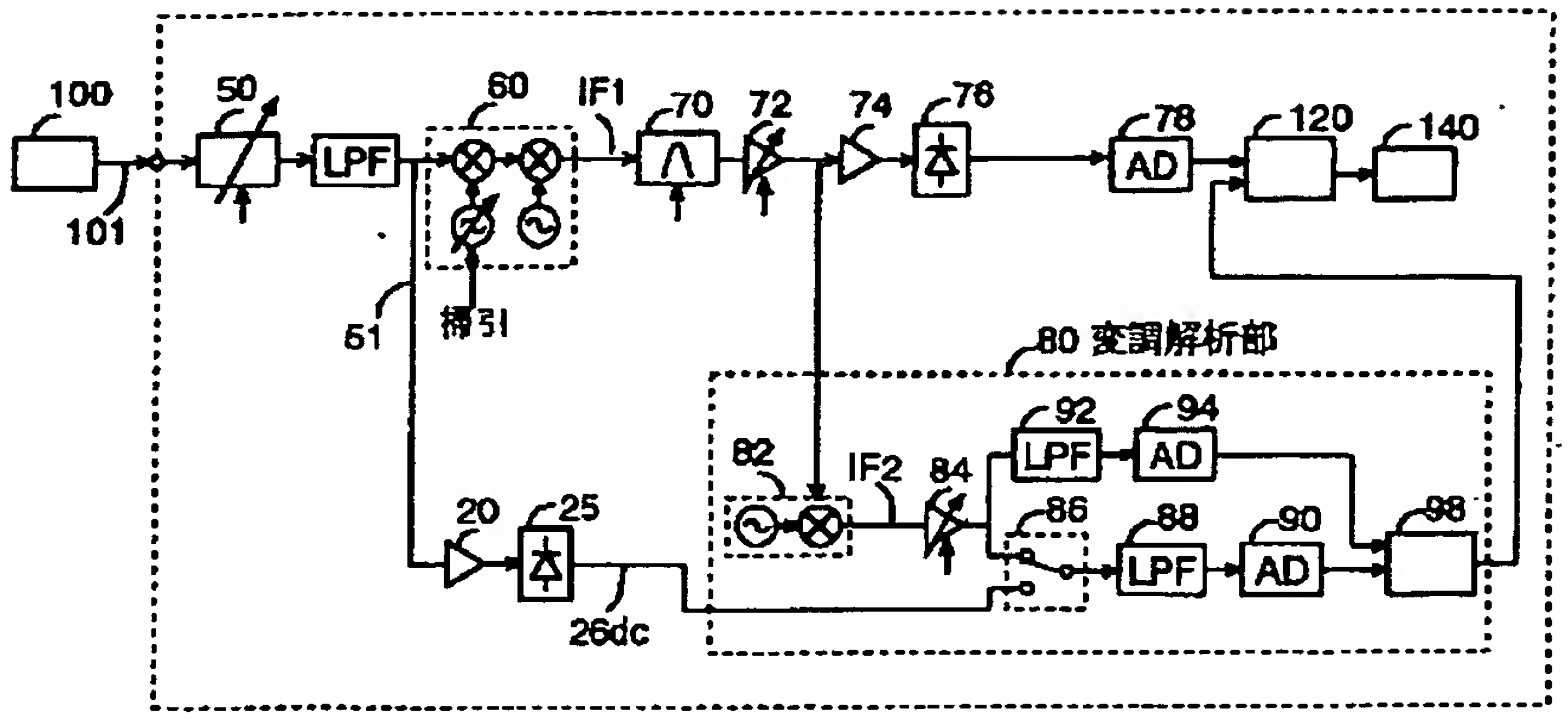
(a)



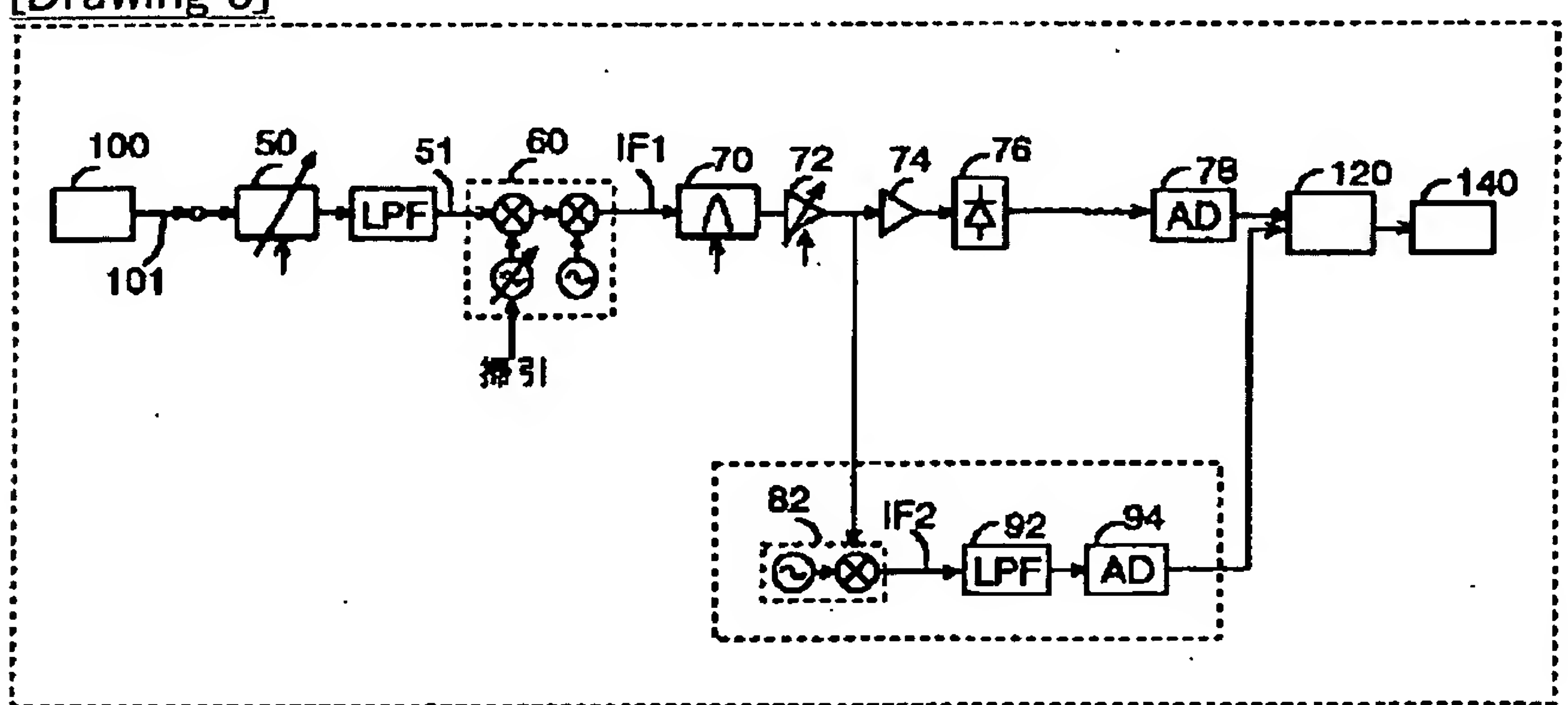
(b) 基本波と3次高調波との差のレベルの推移



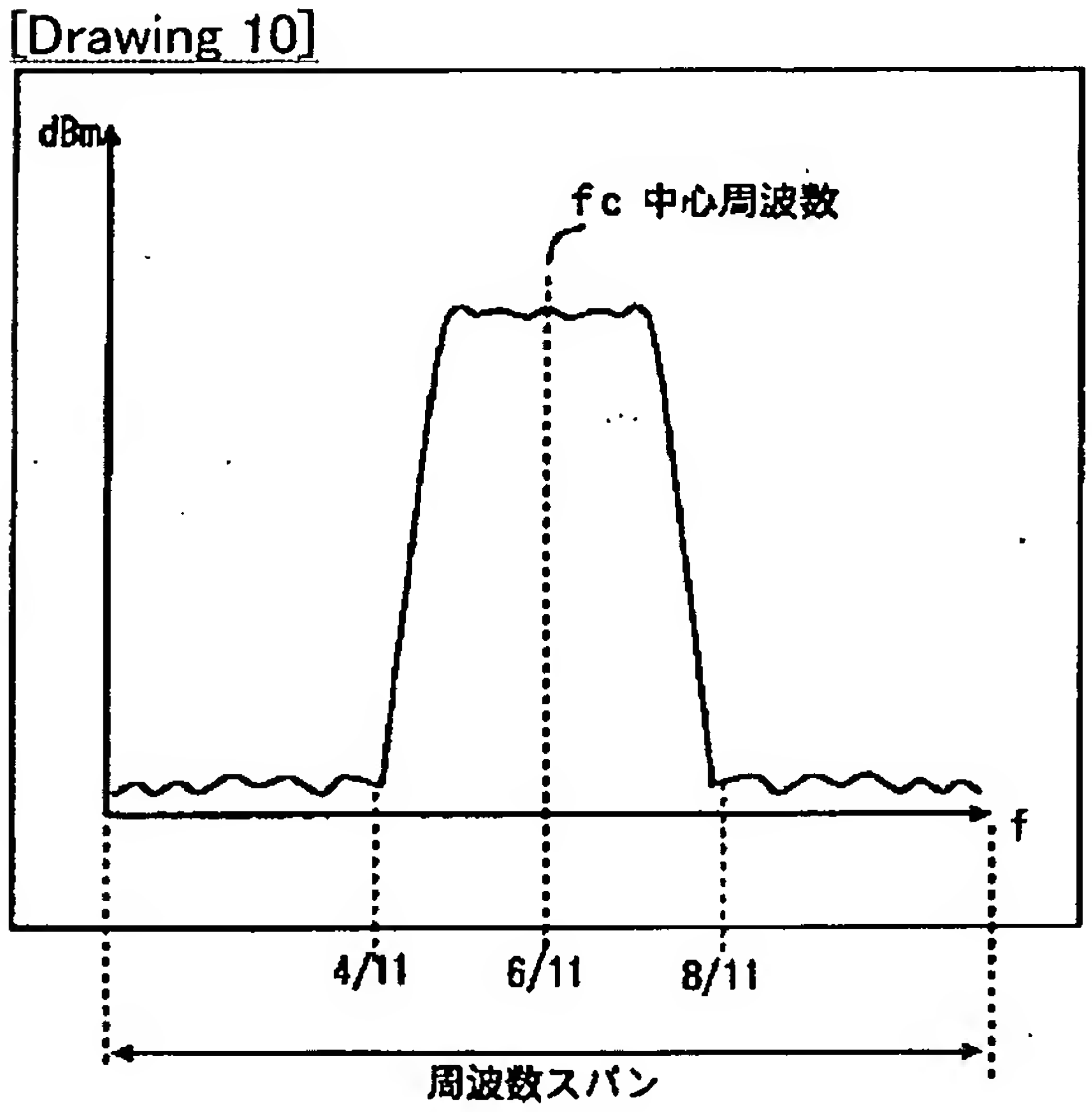
[Drawing 7]



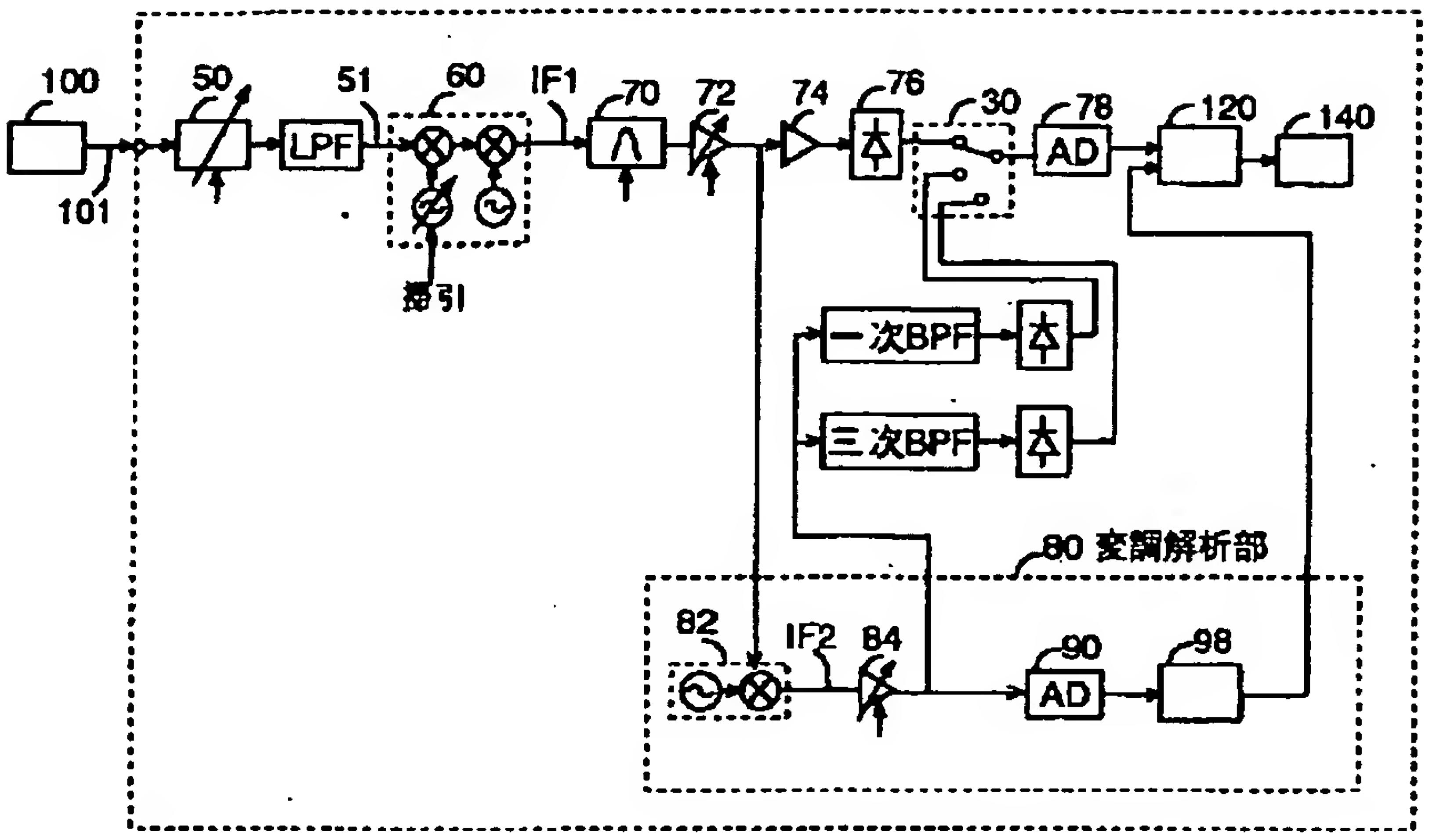
[Drawing 8]



[Drawing 10]



[Drawing 9]



[Translation done.]

WRITTEN AMENDMENT

[procedure amendment]
[Filing Date] October 6, Heisei 9
[Procedure amendment 1]
[Document to be Amended] Description
[Item(s) to be Amended] Whole sentence
[Method of Amendment] Modification
[Proposed Amendment]
[Document Name] Description
[Title of the Invention] Modulation analysis equipment and a spectrum analyzer
[Claim(s)]
[Claim 1] In the modulation analysis equipment which carries out frequency conversion to an intermediate frequency predetermined in the frequency-conversion section in response to the measurement signal-ed of strange power in response to the strange power attenuation signal which was made to decrease with an input attenuator and was decreased, carries out the filter of this by the IF filter, supplies the modulation analysis section, and performs modulation analysis,
A means to amplify and detect this signal in response to the strange power attenuation signal decreased with this input attenuator, and to detect the strange power level in the outgoing end of this input attenuator,
It is the means which carries out setting-out control of the attenuation range in the direction which increases the magnitude of attenuation of this input attenuator when the power level value acquired with this strange power detection means to the 1st is higher than a predetermined upper limit, and carries out setting-out control of the attenuation range in the direction which decrease in number the magnitude of attenuation of this input attenuator when the power-level value acquired with this strange power detection means to the 2nd is lower than a predetermined lower limit,
The means which carries out the frequency sweep of the section including the power measurement band of a measurement signal-ed in the frequency-conversion section in the attenuation range obtained by ****, and the attenuation range of order, carries out measurement calculation of the power of a measurement signal-ed respectively, and carries out setting-out control at the attenuation range optimal based on this measurement power value,
The means which is interlocked with setting out of this attenuation range, controls the gain of the adjustable gain amplifier of an intermediate frequency, and changes the gain control of the gain of the whole system of measurement into a predetermined condition,
Modulation analysis equipment characterized by providing the above.
[Claim 2] In the spectrum analyzer which carries out frequency conversion to an intermediate frequency predetermined in the frequency-conversion section in response to the measurement signal-ed of strange power in response to the strange power attenuation signal which was made to decrease with an input attenuator and was decreased, carries out the filter of this by the IF filter, and is measured,
A means to amplify and detect this signal in response to the strange power attenuation signal decreased with this input attenuator, and to detect the strange power level in the outgoing end of this input attenuator,
It is the means which carries out setting-out control of the attenuation range in the direction which increases the magnitude of attenuation of this input attenuator when the power level value acquired with this strange power detection means to the 1st is higher than a predetermined upper limit, and carries out setting-out control of the attenuation range in the direction which decrease in number the magnitude of attenuation of this input attenuator when the power-level value acquired with this strange power detection means to the 2nd is lower

than a predetermined lower limit,
The means which carries out the frequency sweep of the section including the power measurement band of a measurement signal-ed in the frequency-conversion section in the attenuation range obtained by ****, and the attenuation range of order, carries out measurement calculation of the power of a measurement signal-ed respectively, and carries out setting-out control at the attenuation range optimal based on this measurement power value,
The means which is interlocked with setting out of this attenuation range, controls the gain of the adjustable gain amplifier of an intermediate frequency, and changes the gain control of the gain of the whole system of measurement into a predetermined condition,
The spectrum analyzer characterized by providing the above.
[Claim 3] In the modulation analysis equipment which carries out frequency conversion to an intermediate frequency predetermined in the frequency-conversion section in response to the measurement signal-ed of strange power in response to the strange power attenuation signal which was made to decrease with an input attenuator and was decreased, carries out the filter of this by the IF filter, supplies the modulation analysis section, and performs modulation analysis,
the signal which the frequency-conversion section made the frequency the non-sweep, and was changed into the 2nd still lower intermediate frequency signal in the frequency-conversion section of modulation analysis circles — winning popularity — this — the high-speed A-D converter in which signal processing is possible to the 3rd harmonic content of the 2nd intermediate frequency signal — using — digital data — changing — this — a means to measure the 2nd fundamental-wave component and 3rd harmonic content of an intermediate frequency signal,
A means to change the magnitude of attenuation of the attenuation range of this input attenuator one by one with the measurement means of said 3rd harmonic content, and to measure a fundamental-wave component and the 3rd harmonic content respectively,
A means to specify the attenuation range which a difference with the 3rd harmonic content changes to an increment in response to the value for every attenuation range of the 3rd harmonic content obtained above, and to set the attenuation range of an input attenuator as the optimal range after this,
The means which is interlocked with this optimal range setting out, controls the gain of the adjustable gain amplifier of an intermediate frequency, and changes the gain control of the gain of the whole system of measurement into a predetermined condition,
Modulation analysis equipment characterized by providing the above.
[Claim 4] In the spectrum analyzer which carries out frequency conversion to an intermediate frequency predetermined in the frequency-conversion section in response to the measurement signal-ed of strange power in response to the strange power attenuation signal which was made to decrease with an input attenuator and was decreased, carries out the filter of this by the IF filter, and is measured,
the signal which the frequency-conversion section made the frequency the non-sweep, and was changed into the 2nd still lower intermediate frequency signal in the frequency-conversion section of modulation analysis circles — winning popularity — this — the high-speed A-D converter in which signal processing is possible to the 3rd harmonic content of the 2nd intermediate frequency signal — using — digital data — changing — this — a means to measure the 2nd fundamental-wave component and 3rd harmonic content of an intermediate frequency signal,
A means to change the magnitude of attenuation of the attenuation range of this input attenuator one by one with the measurement means of said 3rd harmonic content, and to measure a fundamental-wave component and the 3rd harmonic content respectively,
A means to specify the attenuation range which a difference with the 3rd harmonic content changes to an increment in response to the value for every attenuation range of the 3rd harmonic content obtained above, and to set the attenuation range of an input attenuator as the optimal range after this,
The means which is interlocked with this optimal range setting out, controls the gain of the adjustable gain amplifier of an intermediate frequency, and changes the gain control of the gain of the whole system of measurement into a predetermined condition,
The spectrum analyzer characterized by providing the above.
[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to optimization of the input level of a test-frequency-ed signal. It is related with optimization of the input level of a test-frequency-ed signal distributed over the broadband by which especially spectrum diffusion was carried out.

[0002]
[Description of the Prior Art] The block diagram of the modulation analysis equipment of drawing 5 is shown and explained about the conventional technical example. This modulation analysis equipment is the example of a configuration which made the spectrum analyzer the basic configuration and added the analysis feature in connection with the various modulations of a measurement signal-ed in response to this intermediate frequency signal (IF signal).
[0003] A configuration changes with the testing device 100-ed, the input attenuator 50, the frequency-conversion section 60, IF filter 70, the adjustable gain amplifier 72, the logarithmic transformation section 74, the detection section 76, A-D converter 78, the modulation analysis section 80, the display-processing section 120, and a display 140. In addition, since the configuration of a spectrum analyzer is known well technically, it omits explanation.
[0004] The internal configuration of the modulation analysis section 80 changes in the frequency-conversion section 82, the adjustable gain amplifier 84, A-D converter 90, and the signal-processing section 98. This modulation analysis section is changed into the several MHz low intermediate frequency signal IF 2 by the frequency-conversion section 82, and carries out the measurement and data processing which carry out a high-speed sampling, carry out signal processing of the intermediate frequency signal amplified on the optimal level of A-D converter 90 with the adjustable gain amplifier 84 by A-D converter 90, and start various kinds of analyses and modulation precision, such as the modulation characteristic. The processed result displays a request with a display 140 through the display-processing section 120.
[0005] By the way, on the occasion of modulation measurement, a user needs to define the display level on the tubular surface of an indicating equipment 140. The order of a way which sets up this tubular surface level is explained. The measurement signal 101-ed which the testing device 100-ed outputs here assumes that it is the case of the signalling frequency which is distributed over broadbands, such as CDMA (Code Division Multiple Access), and by which spectrum diffusion was carried out like the signalling frequency 201 shown in drawing 6 (a). It sets up near center frequency fc first shown in drawing 6 (a), and the input level is indicated by the tubular surface in zero frequency span mode (mode which does not carry out the sweep of the frequency). And by key input setting out, it is set as the desired input sensitivity and the reference level to which spectrum level becomes legible greatly. Automatic setting of the input attenuator 50 and the adjustable gain amplifier 72 for IF signals is carried out to the predetermined magnitude of attenuation and the predetermined amount of magnification as a result of this setting out. In addition, the input attenuator 50 is an attenuator of for example, 10dB step, and the adjustable gain amplifier 72 is adjustable amplifier for example, with a fine 0.1 dB/Div. step.
[0006]
[Problem(s) to be Solved by the Invention] By the way, as shown in drawing 6 (a), the level in each frequency point is low because of the signalling frequency 201 distributed to the broadband. For this reason, setting out of the input attenuator 50 is the small magnitude of attenuation with setting out of the above-mentioned tubular surface display level. However, the total power of the perimeter wave number diffused in the broadband is large level. Consequently, the strange power attenuation signal 51 decreased with the input attenuator 50 shown in drawing 5 is comparatively big level. This signal is supplied to the input edge of the mixer circuit of the frequency-conversion section 60. Consequently, a mixer circuit may serve as an excessive input level. In the case of an excessive input level, a test-frequency-ed signal is distorted, the Nth higher harmonic is produced or nonconformity, like the linearity of frequency-conversion gain changes a lot is produced. These nonconformities have a practical difficulty preferably as a measuring device in order to puff up the modulation analysis of a testing device-ed, and the error of power measurement. In addition, it cannot be overemphasized in the signalling frequency of the strange power which also set to the general spectrum analyzer which does not have the modulation analysis section 80 shown in drawing 5 , and was distributed or dispersed to the broadband etc. that there is same difficulty.
[0007] Then, the technical problem which this invention tends to solve is offering the modulation analysis equipment and the spectrum analyzer which made optimization of an input level realizable also in the test-frequency-ed signal distributed or dispersed to the broadband.
[0008]
[Means for Solving the Problem] Figs. 1 or 2 and drawing 10 show the solution means concerning the modulation analysis equipment of this invention. In order to solve the above-mentioned technical problem to the 1st, with the configuration of this invention It is made to decrease with the input attenuator 50 in response to the measurement signal 101-ed of strange power. In the modulation analysis equipment which carries out frequency conversion to the intermediate frequency IF 1 predetermined in the frequency-conversion section 60 in response to the decreased strange power attenuation signal 51, carries out the filter of this by IF filter 70, -

supplies the modulation analysis section 80, and performs modulation analysis A means to amplify and detect this signal in response to the strange power attenuation signal 51 decreased with the input attenuator 50, and to detect the strange power level in the outgoing end of the input attenuator 50 is provided. Setting-out control of the attenuation range is carried out in the direction which increases the magnitude of attenuation of the input attenuator 50 when the power level value acquired with the above-mentioned strange power detection means to the 1st is higher than a predetermined upper limit. The means of the coarse control which carries out setting-out control of the attenuation range is provided in the direction which decrease in number the magnitude of attenuation of the input attenuator 50 when the power level value acquired with the above-mentioned strange power detection means to the 2nd is lower than a predetermined lower limit. In the attenuation range obtained by ****, and the attenuation range of order, carry out the frequency sweep of the section including the power measurement band of the measurement signal 101-ed in the frequency-conversion section 60, and measurement calculation of the power of the measurement signal 101-ed is carried out respectively. It is a configuration means to provide the means of the optimum coordination which carries out setting-out control in the optimal attenuation range from this measurement power value, and to provide the means which is interlocked with setting out of the above-mentioned attenuation range, controls the gain of the adjustable gain amplifier 72 of an intermediate frequency, and changes the gain control of the gain of the whole system of measurement into a predetermined condition. The modulation analysis equipment which made optimization of an input level realizable also to the test-frequency-ed signal distributed over the broadband with the means of the above-mentioned coarse control and optimum coordination is realizable.

[0009] Drawing 4 shows the solution means concerning the spectrum analyzer of this invention. In order to solve the above-mentioned technical problem to the 2nd, with the configuration of this invention It is made to decrease with the input attenuator 50 in response to the measurement signal 101-ed of strange power. In the spectrum analyzer which carries out frequency conversion to the intermediate frequency IF 1 predetermined in the frequency-conversion section 60 in response to the decreased strange power attenuation signal 51, carries out the filter of this by IF filter 70, and is measured A means to amplify and detect this signal in response to the strange power attenuation signal 51 decreased with the input attenuator 50, and to detect the strange power level in the outgoing end of the input attenuator 50 is provided. Setting-out control of the attenuation range is carried out in the direction which increases the magnitude of attenuation of the input attenuator 50 when the power level value acquired with the above-mentioned strange power detection means to the 1st is higher than a predetermined upper limit. The means of the coarse control which carries out setting-out control of the attenuation range is provided in the direction which decrease in number the magnitude of attenuation of the input attenuator 50 when the power level value acquired with the above-mentioned strange power detection means to the 2nd is lower than a predetermined lower limit. In the attenuation range obtained by ****, and the attenuation range of order, carry out the frequency sweep of the section including the power measurement band of the measurement signal 101-ed in the frequency-conversion section 60, and measurement calculation of the power of the measurement signal 101-ed is carried out respectively. It is a configuration means to provide the means of the optimum coordination which carries out setting-out control in the optimal attenuation range from this measurement power value, and to provide the means which is interlocked with setting out of the above-mentioned attenuation range, controls the gain of the adjustable gain amplifier 72 of an intermediate frequency, and changes the gain control of the gain of the whole system of measurement into a predetermined condition. The spectrum analyzer which made optimization of an input level realizable also to the test-frequency-ed signal distributed over the broadband with the means of the above-mentioned coarse control and optimum coordination is realizable.

[0010] Drawing 3 and drawing 6 (b) show the solution means concerning the modulation analysis equipment of this invention. In order to solve the above-mentioned technical problem to the 3rd, with the configuration of this invention It is made to decrease with the input attenuator 50 in response to the measurement signal 101-ed of strange power. In the modulation analysis equipment which carries out frequency conversion to the intermediate frequency IF 1 predetermined in the frequency-conversion section 60 in response to the decreased strange power attenuation signal 51, carries out the filter of this by IF filter 70, supplies the modulation analysis section 80, and performs modulation analysis The frequency-conversion section 60 makes a frequency a non-sweep (zero frequency span mode), and the signal changed into the 2nd still lower intermediate frequency signal IF 2 in the frequency-conversion section 82 in the modulation analysis section 80 is received. A means to change into digital data using high-speed A-D converter 94 in which signal processing is possible to the 3rd harmonic content of the 2nd intermediate frequency signal IF 2, and to measure the 2nd fundamental-wave component and 3rd harmonic content of the intermediate frequency signal IF 2 is provided. A means to change the magnitude of attenuation of the attenuation range of the above-mentioned input attenuator 50 one by one with

the measurement means of said 3rd harmonic content, and to measure a fundamental-wave component and the 3rd harmonic content respectively is provided. In response to the value for every attenuation range of the 3rd harmonic content obtained above, the attenuation range which a difference with the 3rd harmonic content changes to an increment is specified. A means to, set the attenuation range of the input attenuator 50 as the optimal range from now on is provided, the above-mentioned optimal range setting out is interlocked with, the gain of the adjustable gain amplifier 72 of an intermediate frequency is controlled, and there is a configuration means to provide the means which changes the gain control of the gain of the whole system of measurement into a predetermined condition. The modulation analysis equipment which made optimization of an input level realizable also in the test-frequency-ed signal distributed over the broadband by the above-mentioned technique as a result of transition which the difference of the fundamental-wave component of the 2nd intermediate frequency signal IF 2 and the 3rd harmonic content changes to an increment becoming detectable is realizable.

[0011] Drawing 8 shows the solution means concerning the spectrum analyzer of this invention. In order to solve the above-mentioned technical problem to the 4th, with the configuration of this invention It is made to decrease with the input attenuator 50 in response to the measurement signal 101-ed of strange power. In the spectrum analyzer which carries out frequency conversion to the intermediate frequency IF 1 predetermined in the frequency-conversion section 60 in response to the decreased strange power attenuation signal 51, carries out the filter of this by IF filter 70, and is measured The frequency-conversion section 60 makes a frequency a non-sweep (zero frequency span mode), and the signal changed into the 2nd still lower intermediate frequency signal IF 2 in the frequency-conversion section 82 in the modulation analysis section 80 is received. A means to change into digital data using high-speed A-D converter 94 in which signal processing is possible to the 3rd harmonic content of the 2nd intermediate frequency signal IF 2, and to measure the 2nd fundamental-wave component and 3rd harmonic content of the intermediate frequency signal IF 2 is provided. A means to change the magnitude of attenuation of the attenuation range of the input attenuator 50 one by one with the measurement means of said 3rd harmonic content, and to measure a fundamental-wave component and the 3rd harmonic content respectively is provided. In response to the value for every attenuation range of the 3rd harmonic content obtained above, the attenuation range which a difference with the 3rd harmonic content changes to an increment is specified. A means to, set the attenuation range of the input attenuator 50 as the optimal range from now on is provided, the above-mentioned optimal range setting out is interlocked with, the gain of the adjustable gain amplifier 72 of an intermediate frequency is controlled, and there is a configuration means to provide the means which changes the gain control of the gain of the whole system of measurement into a predetermined condition. The spectrum analyzer which made optimization of an input level realizable also in the test-frequency-ed signal distributed over the broadband by the above-mentioned technique as a result of transition which the difference of the fundamental-wave component of the 2nd intermediate frequency signal IF 2 and the 3rd harmonic content changes to an increment becoming detectable is realizable.

[0012]

[Embodiment of the Invention] The gestalt of operation of this invention is explained with reference to a drawing with an example below at a detail.

[0013] (Example 1) The block diagram of the modulation analysis equipment of drawing 1 is shown and explained about this invention example. In addition, the element corresponding to a configuration attaches the same sign conventionally. In this invention, by the 1st step, the strange power attenuation signal 51 decreased with the input attenuator 50 is measured directly, the coarse control of the attenuation range is carried out, the swept frequency generation of the frequency section including the power measurement band of the measurement signal 101-ed is carried out in the frequency-conversion section 60, power is measured and setting-out control of the input attenuator 50 is eventually carried out in the 2nd step at the optimal range based on this.

[0014] A configuration changes to a component with the configuration of having added the high-frequency amplifier 20, the detection section 25, and a switcher 86, conventionally, as shown in drawing 1 . In advance of measurement of the modulation analysis in the coarse control of the 1st step, magnitude-of-attenuation setting out of the input attenuator 50 is rationalized with a means to explain below. At this time, the switcher 86 is changed to the detection section 25 side.

[0015] The high-frequency amplifier 20 is amplified and outputted to a predetermined scale factor in response to the strange power attenuation signal 51 after decreasing with the input attenuator 50 and passing LPF (low pass filter). In response, the detection section 25 is detected and supplies detected direct-current-voltage signal 26dc to A-D converter 90 through a switcher 86. And the strange power data Dx which carried out digital conversion by A-D converter 90 are supplied to the signal-processing section 98.

[0016] In response to said strange power data Dx, it judges whether it is an excessive input state as compared

with the upper limit level data Dlmt decided beforehand, and by this judgment result, the attenuation range of the input attenuator 50 is changed to a proper value, and is controlled by the signal-processing section 98. In addition, although the above-mentioned upper limit level data Dlmt use as the upper limit level data Dlmt maximum-input-voltage level which gave tolerance in consideration of dispersion in the mixer circuit of the frequency conversion section 60, they may ask for the allowance input level of a mixer circuit respectively for each device of every by request, and may use this as upper limit level data Dlmt.
[0017] In rationalization control of the above-mentioned attenuation range , change an attenuation range in the direction which increase the magnitude of attenuation of the input attenuator 50 since it be an excessive input level when the value of the strange power data Dx measured by the 1st be larger than the upper limit level data Dlmt , control , and this change be interlock with , and make the gain of the adjustable gain amplifier 72 of an intermediate frequency increase , and the setting-out control of the gain of the whole system of measurement carry out so that it may become the original predetermined amplification degree . More than the predetermined level (for example, 10dB) from the upper limit level data Dlmt, to the 2nd, the value of the strange power data Dx changes and controls an attenuation range in the direction which in the case of a low value decrease in number the magnitude of attenuation of the input attenuator 50 since it is a very small input level, is interlocked with this change, decreases the gain of the adjustable gain amplifier 72 of an intermediate frequency, and it carries out setting out control of the gain of the whole system of measurement so that it may become the original predetermined amplification degree. Thereby, the strange power attenuation signal 51 is rationalized.
[0018] With the means of only the above-mentioned detection section 25, it may not necessarily be proper. For this reason, the 2nd-step optimum coordination is performed using the power measurement function of a measuring device. This 2nd-step optimum coordination measures the power value of the signal made into the measuring object, and carries out optimum coordination. That is, the swept frequency generation of the frequency section including the power measurement band of the measurement signal 101-ed is carried out in the frequency-conversion section 60, power is measured, this power measurement is fluctuated from the established state of an attenuation range which obtained the attenuation range of the input attenuator 50 by the coarse control of the 1st step of above-mentioned, and adjustment control of the attenuation range is carried out at the optimal range.
[0019] As shown in the example of power measurement from the frequency spectrum of drawing 10 , specifically, power is computed by integrating with the power of this section using general power measurement application. For example, a frequency shaft is divided into ten on the spectrum display screen, it is [this] under division, and the center frequency of system of measurement is controlled to come the center frequency fc of the measurement signal 101-ed to 5/10 of locations, and a sweep span is automatically controlled so that the band component of the measurement signal 101-ed may be settled in the location of the 8/[2/10 -] 10 section. And it integrates with the power of this section and power is obtained. The power of a measurement signal-ed is obtained from the result obtained by this power measurement, and optimal control in the attenuation range which does not produce distortion by setting out of this attenuation range being interlocked with based on an attenuation range by the 1st step of ****, controlling the gain of the adjustable gain amplifier of an intermediate frequency, and changing the gain of the whole system of measurement into a predetermined condition is attained. Consequently, there is no frequency translation distortion, S/N is good and the advantage whose automatic control of the good attenuation range of the accuracy of measurement becomes possible is acquired.
[0020] After carrying out the above-mentioned rationalization, a switcher 86 is changed to a modulation analysis side, and original modulation analysis is carried out. In addition, rationalization implementation of this magnitude-of-attenuation setting out may be made to perform the key input which starts the interval of modulation analysis measurement, or activation of rationalization of magnitude-of-attenuation setting out by request carrier beam each time or at any time.
[0021] According to the configuration of the above-mentioned invention, measure directly the strange power attenuation signal 51 decreased with the input attenuator 50, and the attenuation range of an outline is specified. Furthermore, since the mixer input edge of the frequency conversion section 60 becomes controllable at a proper input level in order to measure the power of a measurement signal-ed respectively using power measurement application and to change the gain of the whole system of measurement into a predetermined condition based on this result Also in the test-frequency-ed signal distributed over the broadband, rationalization of an input level can be realized exactly easily. Therefore, the big advantage which can cancel the difficulty which a measurement signal-ed is distorted and produces the error factor of modulation analysis and the error factor of power measurement is acquired.
[0022] (Example 2) The block diagram of the modulation analysis equipment of drawing 3 is shown and explained about this invention example. In addition, the element corresponding to a configuration attaches the same sign

conventionally. In this invention, the frequency-conversion section 60 makes the frequency the non-sweep (zero frequency span mode). By changing into digital data using high-speed A-D converter 94 in which signal processing is possible to the 3rd harmonic content of the intermediate frequency signal IF 2, and carrying out detection measurement of the difference of the fundamental-wave component of the 2nd intermediate frequency signal IF 2, and the 3rd harmonic content It is the technique to which the difference of said fundamental-wave component and 3rd harmonic content which were obtained specifies the attenuation range changed to an increment, and carries out setting-out control of the input attenuator 50 after this at the optimal range.

[0023] A configuration changes to a component with the configuration of having added LPF92 and high-speed A-D converter 94 in the modulation analysis section 80, conventionally, as shown in drawing 3 .

[0024] In advance of measurement of modulation analysis, magnitude-of-attenuation setting out of the input attenuator 50 is rationalized with a means to explain below, like an example 1. However, the fundamental frequency beforehand set as the modulation analysis object of the measurement signal 101-ed is obtained. The frequency-conversion section 60 makes a frequency a non-sweep as zero frequency span mode first. The fundamental-wave component and the 3rd harmonic content of the intermediate frequency signal IF 2 which the frequency-conversion section 82 outputs in this condition are measured. For example, when the intermediate frequency signal IF 2 is assumed to be 20MHz, the 3rd harmonic content of a fundamental-wave component is 60MHz in 20MHz. The AC signal containing this 3rd harmonic content is changed into digital data by high-speed A-D converter 94, FFT processing of this data is carried out, and the difference of the fundamental-wave component of the measurement signal 101-ed and the 3rd harmonic content is searched for. The attenuation range of the input attenuator 50 is changed one by one, and measurement processing of the difference of this fundamental-wave component and the 3rd harmonic content is carried out. These measurement results are shown in the example of transition of the 3rd higher-harmonic-wave level of drawing 6 (b). This transition drawing shows that the point 301 is beginning to start to increase. By this judgment result, the attenuation range which should carry out optimal setting out of the input attenuator 50 can be easily found as the point 300. And it cannot be overemphasized that setting out of this attenuation range is interlocked with, the gain of the adjustable gain amplifier 72 of an intermediate frequency as well as an example 1 is made to fluctuate, and setting-out control of the gain of the whole system of measurement is carried out so that it may become the original predetermined amplification degree. Thereby, setting-out control of the input to the mixer circuit of the frequency conversion section 60 is carried out at the optimal input level.

[0025] According to the configuration of the above-mentioned invention, the attenuation range of the input attenuator 50 is changed one by one. By specifying the attenuation range which searches for the difference of the fundamental-wave component of the intermediate frequency signal IF 2, and the 3rd harmonic content which carried out frequency conversion of the measurement signal 101-ed, and transition of the difference level of this fundamental-wave component and the 3rd higher harmonic wave changes to an increment As a result of the optimal attenuation range's becoming detectable, the big advantage which can cancel the difficulty which a measurement signal-ed is distorted and produces the error factor of modulation analysis and the error factor of power measurement is acquired.

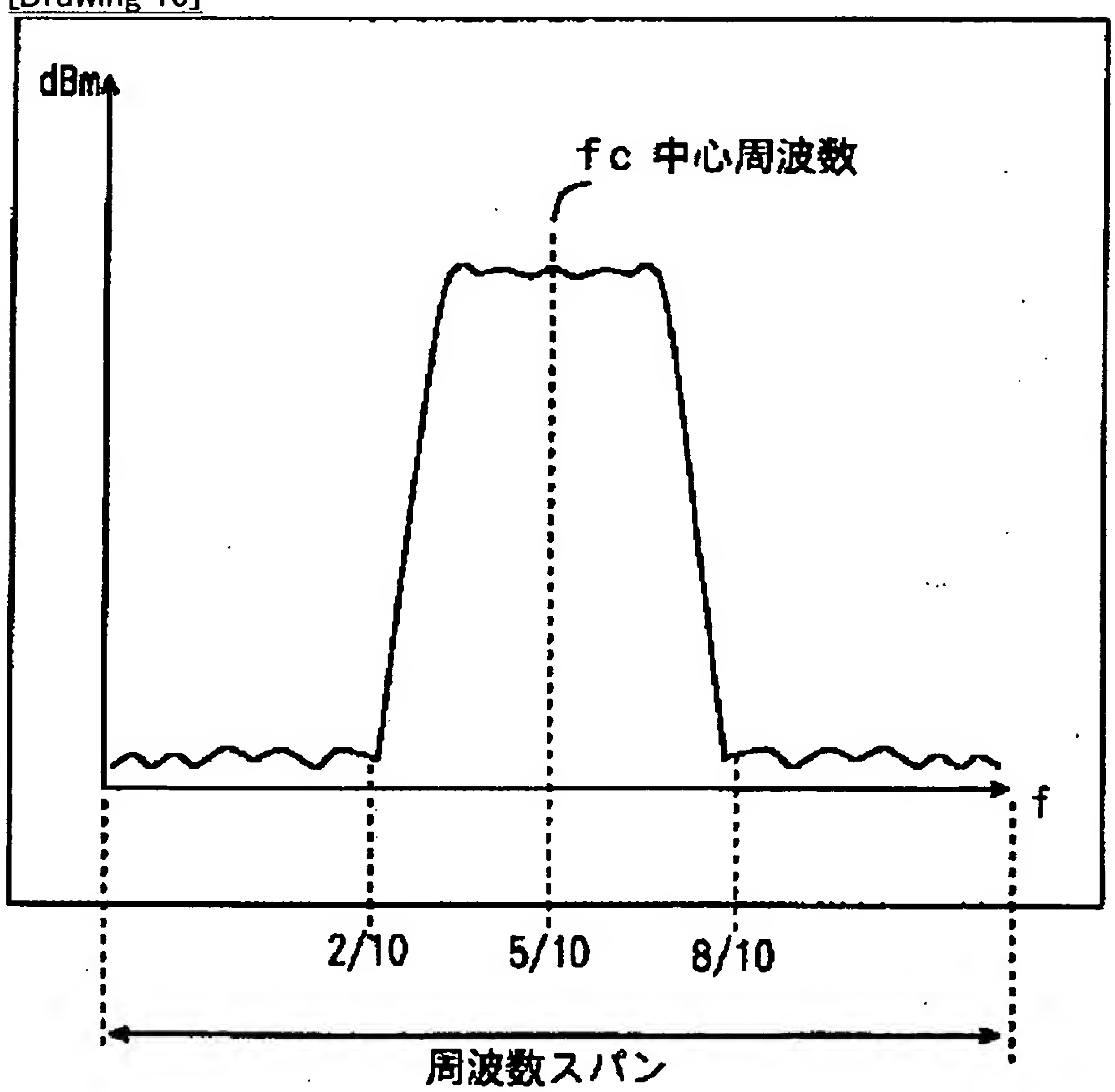
[0026] In addition, by request, although considered as the example of a configuration which measures directly the level of the strange power attenuation signal 51 of the outgoing end of the input attenuator 50 in the above-mentioned example 1 by the example of a concrete configuration of the modulation analysis equipment shown in drawing 1 , as shown in drawing 2 , it is good also as a configuration which measures directly the level of the strange power attenuation signal 51 by the high-frequency amplifier 20, the detection section 25, and the switcher 30, and can carry out similarly.

[0027] In addition, although considered as the example of a configuration which measures the 3rd harmonic content in the above-mentioned example 2 by the example of a concrete configuration of the modulation analysis equipment shown in drawing 3 As a request shows to drawing 9 , the filter of the BPF (band pass filter) which passes only the primary level signal in an intermediate frequency signal is prepared and carried out. Detect this, measure level, and the filter of the BPF (band pass filter) which passes only the Miyoshi level signal in an intermediate frequency signal further is prepared and carried out. Since the attenuation range which detects this, measures level, changes an attenuation range for said measurement one by one, and asks for both primary level signal and Miyoshi level signal, and the difference level of primary and the Miyoshi level changes to an increment after this can be specified It is good also as a configuration means which carries out rationalization control of the attenuation range of the input attenuator 50 similarly.

[0028] In addition, although the example applied to modulation-analysis equipment explained in explanation of the above-mentioned example 1, as shown in drawing 4 , it is clear that optimization of an input level can be similarly

realized by considering as the configuration of the spectrum analyzer which added the high-frequency amplifier 20, the detection section 25, and a switcher 30, measuring directly the level of the strange power attenuation signal 51 similarly decreased with the input attenuator 50, and carrying out the optimum control of the attenuation range.
[0029] In addition, although the example applied to modulation analysis equipment explained also in the above-mentioned example 2 As shown in drawing 8 , it also sets in the configuration of the conventional spectrum analyzer. Form the frequency-conversion section 82, LPF92, and high-speed A-D converter 94, and the attenuation range which carries out sequential measurement and changes the difference of the fundamental-wave component and the 3rd harmonic content which are the technique of the above-mentioned example 2 to an increment from the difference of the fundamental-wave component and the 3rd harmonic content which were obtained is specified. It is realizable by establishing the technique of carrying out rationalization control of the input attenuator 50.
[0030] In addition, although the example of a concrete configuration of the modulation analysis equipment shown in drawing 1 or drawing 3 explained in the above-mentioned example 1, it is good also as a configuration which uses both control means together by request as shown in drawing 7 . That is, after measuring directly the strange power attenuation signal 51 and controlling the input attenuator 50 and the adjustable gain amplifier 72 of an intermediate frequency proper based on this measurement result, it is the configuration which uses together the both-hands method which detects transition which measures a fundamental-wave component and the 3rd higher harmonic further, and the difference of a fundamental-wave component and the 3rd higher harmonic changes to an increment, and is controlled to setting out of the optimal input attenuator 50.
[0031]
[Effect of the Invention] This invention does so the effectiveness indicated by the following from the above-mentioned content of explanation. According to the invention configuration of the above-mentioned example 1, measure directly the strange power attenuation signal 51 decreased with the input attenuator 50 to the 1st, and the attenuation range of an outline is specified as it. Furthermore, by measuring the power of a measurement signal-ed respectively using power measurement application, and changing the gain of the whole system of measurement into a predetermined condition based on this result, since it becomes controllable at a proper input level, the mixer input edge of the frequency conversion section 60 Also in the test-frequency-ed signal distributed over the broadband, rationalization of an input level can be realized exactly easily. Therefore, the big advantage which can cancel the difficulty which a measurement signal-ed is distorted and produces the error factor of modulation analysis and the error factor of power measurement is acquired. Moreover, in the configuration of a spectrum analyzer, the advantage of rationalization of an input level is acquired similarly.
[0032] According to the invention configuration of the above-mentioned example 2, the attenuation range of the input attenuator 50 is changed into the 2nd one by one. By specifying the attenuation range which searches for the difference of the fundamental-wave component of the intermediate frequency signal IF 2 and the 3rd harmonic content which carried out frequency conversion of the measurement signal 101-ed, and transition of the difference level of this fundamental-wave component and the 3rd higher harmonic wave changes to an increment As a result of the optimal attenuation range's becoming detectable, the big advantage which can cancel the difficulty which a measurement signal-ed is distorted and produces the error factor of modulation analysis and the error factor of power measurement is acquired. Moreover, in the configuration of a spectrum analyzer, the advantage of rationalization of an input level is acquired similarly.
[Brief Description of the Drawings]
[Drawing 1] It is the example of a configuration of modulation analysis equipment of this invention.
[Drawing 2] They are other examples of a configuration of modulation analysis equipment of this invention.
[Drawing 3] They are other examples of a configuration of modulation analysis equipment of this invention.
[Drawing 4] It is the example of a configuration of a spectrum analyzer of this invention.
[Drawing 5] It is the conventional example of a configuration of modulation analysis equipment.
[Drawing 6] They are the example of signalling frequency distributed over a broadband, and the example of transition of the level of the difference of a fundamental wave and the 3rd higher harmonic wave.
[Drawing 7] They are other examples of a configuration of modulation analysis equipment of this invention.
[Drawing 8] They are other examples of a configuration of a spectrum analyzer of this invention.
[Drawing 9] They are other examples of a configuration of modulation analysis equipment of this invention.
[Drawing 10] It is the example of power measurement from frequency spectrum of this invention.
[Description of Notations]
20 High-frequency Amplifier
25 76 Detection section

30 86 Switcher
50 Input Attenuator
60 82 Frequency-conversion section
70 IF Filter
72 84 Adjustable gain amplifier
74 Logarithmic Transformation Section
78 90 A-D converter
80 Modulation Analysis Section
94 High-speed A-D Converter
140 Display
98 Signal-Processing Section
100 Testing Device-ed
120 Display-Processing Section
[Procedure amendment 2]
[Document to be Amended] DRAWINGS
[Item(s) to be Amended] drawing 10
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 10]



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